S. HRG. 100-293

CIVILIAN RADIOACTIVE WASTE DISPOSAL

HEARINGS

BEFORE THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

S. 1007

TO ENABLE STATES LOCATED ON A RIVER OR ACQUIFER AFFECTED BY THE SITING OF A REPOSITORY FOR HIGH-LEVEL RADIOACTIVE WASTE OR SPENT NUCLEAR FUEL TO PARTICIPATE EFFECTIVELY IN THE SITE SELECTION, REVIEW, AND APPROVAL PROCESS FOR SUCH REPOSITORY, AND FOR OTHER PURPOSES

S. 1141

ENTITLED THE "NUCLEAR ENERGY WASTE POLICY ACT OF 1987"

S. 1211

ENTITLED THE "NUCLEAR WASTE REPROCESSING STUDY ACT OF 1987"

S. 1266

TO PROVIDE FOR THE ESTABLISHMENT OF REGIONAL MONITORED RETRIEVABLE STORAGE FACILITIES BY THE SECRETARY OF ENERGY AS A WAY TO RESOLVE THE PROBLEM OF HIGH-LEVEL RADIOACTIVE WASTE STORAGE, AND FOR OTHER PURPOSES

S. 1428

ENTITLED THE "SUBSEABED NUCLEAR WASTE DISPOSAL RESEARCH ACT OF 1987"

JULY 16 AND 17, 1987

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Committee on Energy and Natural Resources

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CIVILIAN RADIOACTIVE WASTE DISPOSAL

THURSDAY, JULY 16, 1987

U.S. Senate,
Committee on Energy and Natural Resources,
Washington, DC.

The committee met, pursuant to notice, at 8:55 a.m., in room SD-366, Dirksen Senate Office Building, Hon. Mark O. Hatfield, presiding.

OPENING STATEMENT OF HON. MARK O. HATFIELD, A U.S. SENATOR FROM THE STATE OF OREGON

Senator Hatfield. The hearing will please come to order.

The topic of today's hearing is one with which we are all familiar. In fact, considering the number of hearings already held by the committee this year, it may be safe to say we are overly familiar with the subject.

Accordingly, I thank Chairman Johnston for scheduling this hearing, and I am hopeful that today's session will help in defining the direction in which our country will proceed regarding the disposal of our nuclear waste.

Although each of the five bills that will be addressed today differ in their approach to the nuclear waste problem, they all contain a common thread. That commonality is the fact that each bill was drafted with the recognition that the implementation of the Nuclear Waste Policy Act of 1982 has been a failure. The degree of that failure may be subject to interpretation. But as recent actions indicate clearly, the nuclear waste program is in need of repair. The problem before us is to find a consensus for the extent of those repairs.

With regard to my particular bill, S. 1007, its intended purpose is to allow those states located adjacent to a proposed repository site, which could be affected by the placement of a waste facility due to complications arising from the contamination of shared surface or groundwater to participate in the site selection process. It is evident that nuclear contamination has no regard for state or national borders and the recognition of that fact by the inclusion of a provision in the law is a reasonable proposal.

As most of my colleagues know, my primary interest in amending the Nuclear Waste Policy Act stems from the Department of Energy's selection of the Hanford Nuclear Reservation as one of the three potential sites for the first waste repository. Hanford lies in close proximity to the Columbia River which serves as the boundary between the states of Oregon and Washington. Consequently the major threat of environmental contamination from the location of a repository at Hanford involves the Columbia River.

Although conclusive studies on groundwater movement beneath Hanford are not complete, it is theorized by a number of scientists and geologists that several of the underground aquifers flow in the direction of the Columbia River. While it is believed that the ground water in this area moves very slowly and perhaps would take many years to travel the distance from the repository to the Columbia, the nuclear waste we will be storing has a half-life of several hundred years.

With this in mind, I must ask whether it is worth the risk to locate the repository at Hanford at all.

The Columbia River is Oregon's most important waterway and the Nation's second largest river system. It is a national asset. The waters of the Columbia and its tributaries are used for a myriad of purposes, including navigation and commerce, fishing, irrigation, manufacturing, drinking and the generation of electricity. The contamination of this great river would represent a setback from which Oregon and the Nation never could recover completely.

The potential hazard that the siting of the repository at Hanford represents for Oregon is heightened by the fact that the Columbia River flows past communities that comprise more than half of Oregon's population. It is for these reasons then that I am seeking a voice for the State of Oregon in the siting process.

What I am seeking for the State of Oregon and other potentially affected states is a measure of fairness and equity. Because neighboring states will be required to share the risks and burdens of a waste repository, it is only fair that they should have an equal role in the selection of the repository site. It is my hope that the committee will enact this important legislation.

We have a very distinguished list of witnesses today, and it is a privilege always to be able to welcome to this committee my colleague, Senator Packwood of Oregon. And I invite the Senator to come to the table. And Senator, as I say, we always are not only edified, but we are greatly appreciative of the efforts you make to come and give us the benefit of your opinions on many subjects that this committee must deal with. And so, we welcome you once again. And you may handle your testimony any way you wish.

[The texts of S. 1007, S. 1141, S. 1211, S 1266, and S. 1428 follow:]

II

100TH CONGRESS
1ST SESSION

S. 1007

To enable States located on a river or acquifer affected by the siting of a repository for high-level radioactive waste or spent nuclear fuel to participate effectively in the site selection, review, and approval process for such repository, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 9 (legislative day, MARCH 30), 1987

Mr. HATFIELD introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

A BILL

To enable States located on a river or acquifer affected by the siting of a repository for high-level radioactive waste or spent nuclear fuel to participate effectively in the site selection, review, and approval process for such repository, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 116 of the Nuclear Waste Policy Act of 1982 (Public Law 97–425), is amended by adding at the end thereof the following:

"(e) PARTICIPATIONS OF STATES LOCATED ON AN ADJACENT RIVER OR ACQUIFER.—For any repository for high-level radioactive waste or spent nuclear fuel proposed to be located adjacent to a major river or waterway or above an underground acquifer, any State which lies contiguous to such river or waterway or contiguous to such underground acquifer shall, effective upon the date of enactment of this subsection, have all the same rights and opportunities to participate in the site selection, review, and approval process established by this Act as the State in which the repository is proposed to be located.".

○

II

100th CONGRESS
1st Session

S. 1141

Entitled the "Nuclear Energy Waste Policy Act of 1987".

IN THE SENATE OF THE UNITED STATES

May 6 (legislative day, April 21), 1987

Mr. Hecht introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

A BILL

Entitled the "Nuclear Energy Waste Policy Act of 1987".

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Section 1. Short Title.—This Act may be known as the "Nuclear Energy Waste Policy Act of 1987".

Sec. 2. Finding and Purpose.—(a) The Congress finds that the implementation of the Nuclear Waste Policy Act of 1982 (Public Law 97–425) has not gone as anticipated, and that a safer, simpler, more prudent and less expensive approach to the treatment of high level radioactive waste and spent nuclear fuel is readily available and in the national interest.

(b) The purpose of this Act is to set the United States of America on a path of longterm storage of spent nuclear fuel at or near the point where that spent fuel is generated in anticipation of eventual reprocessing of that fuel or disposal of a far less dangerous material in a repository.

Sec. 3. Amendment to the Nuclear Waste Policy Act.—After section 131 of the Nuclear Waste Policy Act of 1982 (Public Law 97-425) insert the following new section 132, and renumber the subsequent sections accordingly:

"Sec. 132. Storage Period for Spent Fuel.—(a) No spent nuclear fuel shall be transported by or for the Secretary of Energy to a high-level nuclear waste repository until that fuel has been stored for a period of at least fifty years from the time it was removed from the reactor's core.

"(b) Storage must take place over this fifty-year period at one or a combination of the following locations:

"(1) on the grounds of the commercial nuclear powerplant which generated the spent fuel;

"(2) on the grounds of a commercial nuclear powerplant to which spent fuel has been transshipped in accordance with the provisions of this Act and the regulations of the Nuclear Regulatory Commission;

"(3) at a monitored retrievable storage facility licensed by the Nuclear Regulatory Commission.".

○

II

100TH CONGRESS
1ST SESSION

S. 1211

Entitled the "Nuclear Waste Reprocessing Study Act of 1987".

IN THE SENATE OF THE UNITED STATES

MAY 15 (legislative day, MAY 13), 1987

Mr. HECHT introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

A BILL

Entitled the "Nuclear Waste Reprocessing Study Act of 1987".

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION. 1. SHORT TITLE.—This Act may be known as the "Nuclear Waste Reprocessing Study Act of 1987".

SEC. 2. FINDINGS.—The Congress finds that:

(a) the Federal Government has not studied the feasibility of reprocessing for a significant period of time;

(b) reprocessing of spent fuel is not now currently being contemplated by the United States of America;

(c) reprocessing is a proven and effective technology to make the most efficient use of energy resources and to reduce the danger to the public health and safety posed by spent nuclear fuel;

(d) there is substantial reason to believe that reprocessing spent fuel after it has cooled for a number of years may be significantly less costly than reprocessing relatively fresh spent fuel;

(e) serious questions have been raised about the current national program of deep geologic disposal of high level radioactive waste and spent nuclear fuel; and

(f) it is appropriate at this time for the Nation to reconsider the option of reprocessing spent nuclear fuel.

SEC. 3. PURPOSE.—The purpose of this Act is to initiate an analysis of the feasibility of reprocessing spent nuclear fuel before the Federal Government invests substantial amounts of additional ratepayer funds on the deep geologic disposal of spent nuclear fuel, an approach which may now prove inferior to reprocessing from the perspectives of sound energy policy, economic efficiency, and public health and safety.

SEC. 4. SPENT FUEL REPROCESSING STUDY.—By September 30, 1987, the Secretary of Energy shall contract with the National Academy of Sciences for a study of the feasibility of reprocessing spent nuclear fuel. The study shall include an analysis of the economics of reprocessing spent fuel that has first been aged for three years, fifteen years, thirty years, and fifty years. The study shall compare the lifecycle cost of a reprocessing program with the lifecycle cost of the deep geologic disposal of spent fuel as contemplated in the Nuclear Waste Policy Act of 1982 (Public Law 97–425), from site characterization through repository closure. The study shall also address indirect effects of reprocessing and deep geologic disposal, such as the implications for further investment in transportation systems and the implications of reduced mining of uranium, including such topics as environmental consequences, mine reclamation cost, balance of trade considerations, and occupational health and safety considerations.

SEC. 5. SUBMISSION TO CONGRESS.—The National Academy of Sciences shall submit its completed study to Congress no later than September 30, 1989.

SEC. 6. SUSPENSION OF SITE SPECIFIC WORK ON DEEP GEOLOGIC DISPOSAL.—Notwithstanding the Nuclear Waste Policy Act of 1982 (Public Law 97–425), or any other provision of law, the authority of the Secretary of Energy to carry out site specific work on potential repositories for deep geologic disposal of spent nuclear fuel or high level radioactive waste is suspended, as of the date of enactment of this Act. This suspension shall terminate one hundred and eighty days after the National Academy of Sciences submits the study to Congress referred to in section 4 of this Act.

SEC. 7. FUNDING.—The Nuclear Waste Fund established by the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10222) shall be the source of funds for the work performed under this Act.

○

II

100TH CONGRESS
1ST SESSION

S. 1266

To provide for the establishment of regional monitored retrievable storage facilities by the Secretary of Energy as a way to resolve the problem of high-level radioactive waste storage, and for other purposes.

IN THE SENATE OF THE UNITED STATES

MAY 21 (legislative day, MAY 13), 1987

Mr. EVANS (for himself, Mr. MURKOWSKI, and Mr. HECHT) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

A BILL

To provide for the establishment of regional monitored retrievable storage facilities by the Secretary of Energy as a way to resolve the problem of high-level radioactive waste storage, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "High-Level Radioactive Waste Storage Act of 1987".

SEC. 2. AUTHORIZATION OF MONITORED RETRIEVABLE STORAGE FACILITIES.

Subtitle C of title I of the Nuclear Waste Policy Act of 1982 is amended by—

(1) inserting after the caption for such subtitle the following:

"PART 1—SITING AND CONSTRUCTION OF THE FIRST MONITORED RETRIEVABLE STORAGE FACILITY";

and

(2) adding at the end thereof the following:

"PART 2—ADDITIONAL MONITORED RETRIEVABLE STORAGE FACILITIES

"FINDINGS

"SEC. 145. The Congress finds that —

"(1) the storage and disposal of high-level radioactive waste is a national problem that requires a partnership between Federal Government and States, local governments, and Indian tribes to resolve;

"(2) the present situation of the Federal nuclear waste program is in serious disarray and requires a substantial mid-course correction;

"(3) the location of storage and disposal sites for high-level radioactive waste should reflect, to the greatest extent possible, proximity to the beneficiaries of the generation of nuclear power for electricity;

"(4) each region of the country which benefits from the generation of nuclear power should equitably bear the full costs of the interim storage and long-term disposal of spent nuclear fuel through the siting and development of regional monitored retrievable storage facilities;

"(5) the storage of high-level radioactive waste in monitored retrievable storage facilities for a period of fifty years or more offers numerous technical advantages, including reduction in thermal load and radioactivity and substantial reductions in the final cost of geologic disposal;

"(6) a system of regional monitored retrievable storage facilities offers a safe and scientifically sound solution to resolve the institutional and technical questions regarding the safe storage of high-level radioactive waste while providing our society more time to resolve the long-term issues regarding permanent disposal;

"(7) thorough technical analysis and scientific credibility should be the basis and primary criteria for the guidelines for the selection of any nuclear waste disposal facility;

"(8) greater compensation, based on a long-term rental concept, should be offered to State and local governments following the selection of a technically sound site and licensing by the Commission;

"(9) high-level radioactive waste in the form of spent nuclear fuel contains a large source of valuable energy that future generations may wish to extract and make use of, therefore retrievability of the waste should be ensured in some manner; and

"(10) the reprocessing of spent nuclear fuel may offer significant long-term economic and environmental benefits by recycling valuable isotopes of high energy value and by closing the back end of the nuclear fuel cycle.

"SUSPENSION OF PERMANENT REPOSITORY ACTIVITIES UNTIL JANUARY 31, 1998

"SEC. 146. (a) SUSPENSION.—Upon the date of enactment of this part, the authority granted by the provisions of this Act with respect to the siting or construction of any repository, including the development of site characterization plans and any other activities, is revoked for a period beginning on the date of enactment of this part and ending January 31, 1998.

"(b) INTERIM REASSESSMENT OF POTENTIALLY SUITABLE REPOSITORY SITES—(1)(A) During the suspension period provided in subsection (a) the Secretary of the Interior shall conduct a national survey and prepare a list of potentially suitable sites for a deep geologic repository for high-level radioactive waste and spent nuclear fuel.

"(B) In conducting the survey, the Secretary of the Interior—

"(i) shall consider, but need not be limited to, the general guidelines specified in section 112(a);

"(ii) shall consider a diversity of geologic media, and include sites in various geologic media in the recommendation to the Department of Energy; and

"(iii) shall not favor Federal sites over non-Federal sites.

The list prepared pursuant to this subsection shall include at least 9 potentially suitable sites in at least 3 different geologic media for a geologic repository.

"(2) In addition to the survey required by paragraph (1), the Secretary shall conduct a study on the need for a second geologic repository based on the following factors:

"(A) the most recent data from the Department and other sources on spent nuclear fuel generation estimates;

"(B) the technical advantages afforded by the regional monitored retrievable storage facilities authorized pursuant to part 1; and

"(C) any technological or policy changes in waste management occurring in this period.

The study shall be submitted to the Congress January 1, 1998, along with the recommendations of the Secretary for the characterization of a site for a second repository, if necessary.

"(3)(A) After receipt of recommendations of potentially suitable sites by the Secretary of the Interior pursuant to paragraph (1), and the Secretary of Energy pursuant to paragraph (2), the Secretary of Energy shall seek to enter into consultation and cooperation with States and Tribes.

"(B) On or before July 1, 1998, the President, based on recommendations of the Secretary, shall recommend and submit to Congress at least one site for site characterization activities for a repository.

"(C) Along with such recommendation, the Secretary shall submit a revised timetable to the Congress for the characterization, licensing, and construction of such a repository. Such a recommendation will include necessary changes in legislation to accomplish the revised timetable for the development of one or more repositories.

"(D) If the study under paragraph (2) concludes there is a need for a second repository, the President, based on the recommendations of the Secretary, shall recommend at least one site for site characterization by July 1, 2003. Such a site shall be in a different geologic media from the first repository.

"AUTHORIZATION OF FACILITIES AND SITE SELECTION

"SEC. 147. (a) AUTHORIZATION.—(1) The Secretary of Energy is authorized to develop and construct within the United States 3 monitored retrievable storage facilities in addition to the facility described in part 1 for the storage of high-level radioactive waste and spent nuclear fuel to be selected and constructed in accordance with the provisions of section 141 and this part.

"(2) Each such facility shall be designed—

"(A) to accommodate spent nuclear fuel and high-level radioactive waste resulting from nuclear activities;

"(B) to permit continuous monitoring, management, and maintenance of such spent fuel and waste for the foreseeable future;

"(C) to provide for the ready retrieval of such spent fuel and waste for further processing or disposal; and

"(D) to safely store such spent fuel and waste as long as may be necessary by maintaining such facility through appropriate means, including any required replacement of such facility.

"(3) Nothing in this part shall be construed as affecting the siting and construction of the first monitored retrievable storage facility pursuant to part 1.

"(b) SITE SELECTION CRITERIA.—The sites for 3 additional monitored retrievable storage facilities authorized by subsection (a) shall be selected through the application of the following criteria:

"(1) Technical guidelines described in section 112(a) relating to geologic, seismic, hydrologic, geophysics, natural resource, and water supply considerations;

"(2) Proximity to the source and beneficiaries of the generation of nuclear power;

"(3) Minimizing transportation distances from the nuclear power facility to the monitored retrievable storage facility;

"(4) Existing Federal facilities shall be considered prior to non-Federal facilities including not only Department of Energy-owned but other Federal facilities; and

"(5) Commission licensed facilities, either operated or partially completed with only a construction license, shall be considered prior to consideration of other non-Federal sites.

"(c) LOCATION OF 3 ADDITIONAL SITES.—The Secretary shall select one site in 3 of the 4 following regions which do not contain the facility constructed pursuant to part 1:

"(1) Northeast Mid-Atlantic: Connecticut, Maine, Massachusetts, Rhode Island, Vermont, New Hampshire, New York, New Jersey, Pennsylvania, Delaware, District of Columbia, and Maryland.

"(2) Southeast: Alabama, Florida, Georgia, Mississippi, North Carolina, Tennessee, South Carolina, Virginia, West Virginia, Louisiana, and Arkansas.

"(3) Midwest North Central: Indiana, Kansas, Michigan, Minnesota, Missouri, Ohio, Wisconsin, Illinois, Kentucky, Oklahoma, Texas, North Dakota, South Dakota, and Iowa.

"(4) West Rocky Mountain: any State not included in clauses (1), (2), and (3).

The regions created by this subsection reflect, to the greatest extent possible, the regional distribution of the electric generation of our Nation's commercial nuclear power at the date of enactment of this part.

"GUIDELINES

"SEC. 148. (a) PROMULGATION BY THE SECRETARY.—Within one year after the date of enactment of this part, the Secretary shall develop guidelines for the selection of 3 additional monitored retrievable storage facilities based on the criteria provided in section 141(b) and section 147(b) and submit such guidelines to the Administrator of the Environmental Protection Agency and the Commission for review.

"(b) EPA AND NRC REVIEW.—After receipt of the guidelines submitted pursuant to subsection (a), the Administrator of the Environmental Protection Agency and the Commission shall review the guidelines and within 18 months after the date of enactment of this part shall submit guideline modifications to the Secretary which shall be incorporated into the guidelines. The Secretary shall have the authority to resolve any inconsistencies among such recommendations.

"(c) COMPLETION OF GUIDELINES.—The Secretary shall issue final guidelines under this section within 2 years after the date of enactment of this part.

"IMPLEMENTATION AND CONSTRUCTION

"SEC. 149. (a) SITE SELECTION.—Using the guidelines developed pursuant to section 148, the Secretary shall—

"(1) three years after the date of enactment of this part develop and submit to Congress a list of all potentially suitable sites for a monitored retrievable storage facility, including commission-licensed facilities;

"(2) four years after the date of enactment of this part develop a proposal that recommends 3 sites for monitored retrievable storage facilities, one in each of the 3 regions described in section 147(c);

"(3) select a preferred site and 2 alternative sites within each region to be developed by the Department of Energy in the proposal;

"(4) submit environmental assessments required by 141(c), along with proposals to Congress; and

"(5) consult with the States and affected Indian Tribes as provided in section 117 and enter into a binding written agreement prior to the initiation of construction activities.

"(b) CONSTRUCTION OF 3 Additional MRS Facilities.—(1) Subject to the provisions of paragraph (2), the Secretary shall commence construction of the 3 monitored retrievable storage facilities authorized by this part 6 years after the date of enactment of this part. Facilities constructed under this part shall be completed and available for the acceptance of high-level radioactive waste and spent nuclear fuel by January 31, 2002. These activities shall be subject to appropriations pursuant to section 302(c).

"(2) Any construction commenced pursuant to paragraph (1) shall be subject to licensing by the Commission.

"(3) The requirements of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) shall apply with respect to construction commenced pursuant to paragraph (1), except that any environmental impact statement prepared with respect to a facility shall not be required to consider the need for such facility or any alternative to the design criteria for such facility.

"(c) LIMITATION.—No repository may be constructed in any State in which there is located a monitored retrievable storage facility developed pursuant to this subtitle.

"(d) WASTE WITHIN EACH REGION.—Upon the construction and commencement of operation of the 4 monitored retrievable storage facilities authorized by this subtitle, any high-level radioactive waste generated or located in one of the 4 regions described in section 147(c) shall thereafter be stored within such region.

"(e) STORAGE SITE ELECTION BY FACILITIES.—(1) Three years after the date of enactment of this part, each person who generates or holds title to high-level radioactive waste, or spent nuclear fuel, of domestic origin shall elect, with respect to such waste or fuel, to—

"(A) enter into a contract with the Secretary for the storage of such waste or fuel at a monitored retrievable storage facility developed pursuant to this subtitle; or

"(B) subject to approval by the Secretary and licensing and approval by the Commission, provide for the storage of such waste at the site of the generating facility.

"(2) At the end of the 3-year period provided in paragraph (1), the Secretary shall develop an estimate for each region of the amount of spent nuclear fuel designated for—

"(A) storage at a regional monitored retrievable storage facility; and

"(B) storage at the reactor site subject approval by Secretary and licensing by Commission.

"(3) Based on the estimate prepared under paragraph (2), the Secretary shall develop specific design and engineering criteria for the monitored retrievable storage facility in each region. Each such facility—

"(A) shall have a capacity of at least 15,000 metric tons of spent nuclear fuel or high-level radioactive waste; and

"(B) should be capable of storing such waste for 50 years after irradiation and removal from reactor core.

"(4) For those utilities who elect at-reactor storage under paragraph (1)(B), the Secretary may reduce the annual fee obligations for such utility to a level that will not adversely affect the activities of the Nuclear Waste Program necessary to carry out the goals of this Act. Such funding shall be no less than 25 percent of the current fee established by the Secretary.

"(5) The Secretary shall submit a new estimate of necessary funding for program activities and a list of utilities electing at-reactor storage in the annual fee adequacy report required under section 302(a)(4). Any reduced fee for utilities choosing the paragraph (1)(B) option shall be uniform and based on gross generation of electricity per kilowatt-hour.

"FINANCIAL ASSISTANCE AND FUNDING

"SEC. 150. (a) IMPACT ASSISTANCE AND FINANCIAL GRANTS.—The Secretary shall make grants to States and Tribes pursuant to the provisions of sections 116(c), 118(b), and 141(f) for assistance for the construction and operation of a monitored retrievable storage facility under this part. Payment pursuant to section 141(f) for the additional 3 facilities shall begin with the issuance of a license by the Commission for the facility.

"(b) LONG-TERM RENTAL BENEFITS.—(1) In addition to payments under subsection (a), States or Tribes which agree to accept a monitored retrievable storage facility pursuant to an agreement reached in accordance with the provisions of section 117 shall be eligible for compensation under the terms and conditions of sections 116(c), 118(b), and 141(f). Such compensation shall be in the form of annual spent fuel payments for which there is authorized to be appropriated $100,000,000 per year from the Nuclear Waste Fund subject to the provisions of section 302(c). Annual spent fuel payments will begin with the arrival of the first spent nuclear fuel shipments to such monitored retrievable storage facility.

"(2) If the first annual spent fuel payment under paragraph (1) is made within 6 months after the last annual payment prior to receipt of spent fuel, the first spent fuel payment shall be reduced by an amount equal to one-twelfth of such annual payment for each full month less than 6 that has not elapsed since the last annual payment.

"(3) Any State receiving payments under this section shall transfer not less than one-half of such payment to units of general local government affected by the monitored retrievable storage facility.

"(4) Annual spent fuel payments under paragraph (1) shall be made for the life of the monitored retrievable storage facility until closure and the commencement of decommissioning of the facility.".

SEC. 3. RESEARCH ON SUBSEABED AND OTHER ALTERNATIVE DISPOSAL METHODS.

Section 222 of title II of the Nuclear Waste Policy Act is amended to read as follows:

"SEC. 222. RESEARCH ON ALTERNATIVES FOR THE PERMANENT DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE.

"(a) CONTINUATION AND ACCELERATION OF PROGRAM.—The Secretary shall continue and accelerate a program of research, development, and demonstration of alternative methods and technologies for the permanent disposal of high-level radioactive waste and spent fuel, including subseabed disposal.

"(b) SUBSEABED CONSORTIUM.—(1) Within 60 days after the date of enactment of this section, the Secretary shall establish a university-based consortium involving leading oceanographic universities and institutions, national laboratories, and private research firms to investigate the feasibility of subseabed disposal. The Consortium shall be included in the office of Civilian Radioactive Waste Management under a new 'Office of Alternative Disposal Methods', which shall have an Associate Director. The Secretary shall seek cooperation of the National Academy of Sciences in reviewing the research plan and activities of the Consortium. The Secretary shall seek the maximum possible financial contribution from foreign governments for research activities carried out through international collaboration.

"(2) The Subseabed Consortium shall develop a research plan and budget to achieve the following objectives by 1995:

"(A) demonstrate the capacity to identify and characterize potential subseabed disposal sites;

"(B) develop conceptual designs for a subseabed disposal system, including estimated costs and institutional requirements; and

"(C) identify and assess the potential impacts of subseabed disposal on human health and the marine environment.

"(3) On or before December 31, 1995 or upon the date achieving the objectives of its research plan, whichever date is the earlier, the Subseabed Consortium shall prepare and submit to Congress a final report on the results of its research activities.

"(c) FUNDING.—(1) There is hereby authorized to be appropriated from the Nuclear Waste Fund $200,000,000 over an 8-year period beginning with the first fiscal year beginning after the date of enactment of this section—

"(A) of which $150,000,000 shall be available for the Subseabed Consortium in conducting the study required by subsection (b); and

"(B) of which $50,000,000 shall be available to the Secretary to fund studies for alternative high-level radioactive waste disposal systems other than subseabed disposal.

"(2) No funds may be appropriated or expended pursuant to paragraph (1)(A) unless the Secretary has made a determination that foreign governments are contributing an equitable share of funds to international subseabed disposal research and development.".

SEC. 4. RADIOACTIVE MATERIALS TRANSPORTATION.

Section 105 of the Hazardous Materials Transportation Act (Public Law 93-633; 49 U.S.C. 1804) is amended by adding at the end thereof the following new subsection:

"(d) PERMISSIBLE STATE REGULATION.—(1) Notwithstanding the authority granted under this section or any other provision of this Act, a State or political subdivision may regulate the transportation of hazardous materials within the jurisdiction of the State or political subdivision to the extent provided in paragraph (2).

"(2) A State or political subdivision of a State may regulate the transportation of hazardous materials by—

"(A) designating highway routes for transporting radioactive materials and restricting use of such routes by imposing rush-hour curfews for transporting wastes in urban areas, or completely banning transporting wastes through urban areas unless no practical alternative exists;

"(B) requiring transport permits and imposing transport fees, provided these are not shown to be unreasonable in amount in relation to the costs incurred by that State for emergency response preparation, inspection services, and enforcement;

"(C) requiring driver training on the hazards of radioactive materials and emergency procedures in the event of an accident involving these materials; and

"(D) requiring carriers to provide records of shipments which have moved through the territory of the State or local subdivision for the purpose of improving emergency response capabilities, as well as inspection and enforcement along frequently used routes.

In regulating the transportation of hazardous materials under this subsection, no State may pose an unreasonable burden on interstate commerce.".

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II

100TH CONGRESS
1ST SESSION

S. 1428

Entitled the "Subseabed Nuclear Waste Disposal Research Act of 1987".

IN THE SENATE OF THE UNITED STATES

JUNE 25 (legislative day, JUNE 23), 1987

Mr. HECHT introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

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A BILL

Entitled the "Subseabed Nuclear Waste Disposal Research Act of 1987".

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.—This Act may be known as the "Subseabed Nuclear Waste Disposal Research Act of 1987".

SEC. 2. FINDINGS.—The Congress finds that research on the subseabed disposal of high level radioactive waste and spent nuclear fuel—

(a) is necessary and appropriate for the Federal Government to comply with the Nuclear Waste Policy

Act of 1982 and the National Environmental Policy Act of 1969;

(b) may eventually result in an alternative that is safer and less expensive than deep geologic disposal of nuclear wastes in the United States;

(c) offers an opportunity for the United States to foster international cooperation on an issue of great social and scientific interest;

(d) may assist in the effort to prevent the proliferation of nuclear weapons; and

(e) will allow the United States to improve its capabilities in oceanographic research and technology development.

SEC. 3. PURPOSE.—The purpose of this Act is to encourage research on subseabed disposal of nuclear waste so the nation may have the most efficient and effective nuclear waste management program.

SEC. 4. AMENDMENT TO NUCLEAR WASTE POLICY ACT.—The Nuclear Waste Policy Act of 1982 (Public Law 97–425) is amended by the insertion of a new section 304A, as follows:

"OFFICE OF SUBSEABED DISPOSAL RESEARCH

"SECTION 304A. (a) ESTABLISHMENT.—There is hereby established an Office of Subseabed Disposal Reseach within the Office of Energy Research of the Department of Energy. The Office shall be headed by a Director, who shall be a member of the Senior Executive Service appointed by the Director of the Office of Energy Research, and compensated at a rate determined by applicable law.

"(b) FUNCTIONS OF DIRECTOR.—The Director of the Office of Subseabed Disposal Research shall be responsible for carrying out research, development, and demonstration activities on all aspects of subseabed disposal of high level radioactive waste and spent nuclear fuel, subject to the general supervision of the Secretary. The Director of the Office shall be directly responsible to the Director of the Office of Energy Research, and the first such Director shall be appointed within thirty days of the date of enactment of this Act.

"(c) In carrying out his responsibilities under this Act, the Secretary may make grants to, or enter contracts with, the Seabed Consortium described in subsection (d) of this section, and other persons.

"(d) SEABED CONSORTIUM.—(1) Within sixty days of the date of enactment of this Act, the Secretary shall establish a university-based Seabed Consortium involving leading oceanographic universities and institutions, national laboratories, and other organizations to investigate the technical and institutional feasibility of subseabed disposal.

"(2) The Seabed Consortium shall develop a research plan and budget to achieve the following objectives by 1995—

"(i) demonstrate the capacity to identify and characterize potential subseabed disposal sites;

"(ii) develop conceptual designs for a subseabed disposal system, including estimated costs and institutional requirements; and

"(iii) identify and assess the potential impacts of subseabed disposal on the human and marine environments.

"(3) In 1990, and again in 1995, the Subseabed Consortium shall report to Congress on the progress being made in achieving the objectives of subparagraph (2).

"(e) ANNUAL REPORT.—The Director of the Office of Subseabed Disposal Research shall annually prepare and submit a report to the Congress on the activities and expenditures of the Office.

"(f) FUNDING AUTHORIZATION.—The Nuclear Waste Fund established in section 302 of this Act shall be the source of funds for activities carried out under this section.".

○

STATEMENT OF HON. BOB PACKWOOD, A U.S. SENATOR FROM THE STATE OF OREGON

Senator Packwood. Mr. Chairman, Senator Hecht, thank you very much. This is once more where the Chairman and I are allied together in what must now be the five hundredth of five thousandth common cause we have been engaged in together over the past 40 years.

If the Chairman would indulge me, my statement is only four pages tripled spaced, and I would just as soon read it.

Senator Hatfield. Please do.

Senator Packwood. Mr. Chairman, I appreciate the opportunity to testify on S. 1007 introduced by yourself and others. I am pleased to co-sponsor this bill amending the Nuclear Waste Policy Act of 1982 to give states that may be affected by a proposed nuclear waste repository the same rights as states hosting the proposed repository.

Under current law only states that are finalists for a nuclear waste site and affected Indian tribes are eligible to receive technical and financial assistance to determine the effects of a repository.

This bill would give states that share a waterway or underground aquifer with a proposed site equal protection and assistance to determine the potential impact on their state. This provision is necessary because a neighboring state may be affected, if not more affected, by an accident or a leak of radioactive materials.

As a Senator from Oregon, I am deeply concerned about the potential contamination of the Columbia River by the Hanford Nuclear Reservation in Washington State. Hanford, as the Chairman is well aware, is one of the three finalists for a nuclear repository. The nuclear reservation is located on the Columbia River. This waterway stretches 343 miles between Oregon and Washington and is the main source of food, irrigation and transportation for both states. And I might say here as an aside, Mr. Chairman and Senator Hecht, I realize the tremendous interest of the State of Washington in this affair, but the Columbia River actually borders on our main population area, whereas on the southern part of the State of Washington and apart from the Clark County of Vancouver area is a relatively slightly populated part of the State of Washington.

Possible contamination of the farmlands along the Columbia River would affect everyone in Oregon and would devastate the northwest economy. The risk of such contamination should be one of the major criteria in the evaluation of Hanford's potential as a nuclear waste repository.

This provision is important not only to Oregon, but to a number of states that share a body of water with potential nuclear waste storage sites in Texas and Nevada. Since water acts as a vehicle for carrying radioactive particles, it is critical that states sharing a river or aquifer be able to participate in the siting process.

Although the groundwater issue is still being analyzed, studies of Hanford's groundwater have indicated the potential of contamination. We cannot afford to take chances given the 10,000 year life span of the waste. If any errors are made, it is better that they be on the side of caution.

In conclusion, Mr. Chairman, I cannot over-emphasize the importance of allowing affected states the ability to participate in the siting process. States that share a water resource with a potential nuclear storage site should be given the opportunity to fully participate in the site evaluation and selection process to protect their interests, and this bill would assure that Oregon will have a voice in the nuclear waste siting process.

And I might add in conclusion I am well aware of the success that the Chairman of the committee, Senator Hatfield, has had in getting money through the appropriation process of $2,500,000 for Oregon over five years. What he is trying to do and what I am trying to join with him here is to insure that that process is an authorization so we do not have to depend upon the continual good offices of Senator Hatfield to provide that through an appropriation process.

Thank you very much, Mr. Chairman.

Senator **Hatfield**. Thank you very much, Senator Packwood.

Senator Hecht, do you have any remarks?

Senator **Hecht**. Thank you, Mr. Chairman. Yes, I have a statement. My staff is en route. I am an old retailer, so I always like to get there about 10 minutes early to open up my business. But my staff does not understand that yet. [Laughter.]

When my staff gets here, I have a statement which I would like to give at that time.

Senator **Packwood**. I am sure if your staff is not here, they are well on their way right now.

Senator **Hecht**. Well, I hope so.

Senator **Hatfield**. The Senator will be able to present his retail statement. [Laughter.]

Senator **Packwood**. Thank you very much.

Senator **Hatfield**. Thank you, Senator Packwood, very much.

I would like to invite at this time the Honorable Ben Rusche, the Director of the Office of Civilian Radioactive Waste Management from the Department of Energy. Mr. Rusche, again, let me express our appreciation for your coming up on the Hill today. You have been a very wise counselor to this committee. With or without agreement is not the predication upon which I make that statement. I assume you are here to endorse my bill.

STATEMENT OF BEN C. RUSCHE, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, DEPARTMENT OF ENERGY

Mr. **Rusche**. Mr. Chairman, I do have a statement to make.

Senator **Hatfield**. Please handle it as you wish.

Mr. **Rusche**. Mr. Chairman and Senator Hecht, members of the committee, I appreciate the opportunity to appear before you today to discuss the Department of Energy's comments on five legislative proposals related to nuclear waste that are under consideration by the Committee.

By way of perspective, I understand that more than 30 bills have been introduced in the 100th Congress that would affect nuclear waste transportation or disposal. Each of these bills would to one extent or another alter the course of the U.S. nuclear disposal program presently under way. This being the case, it may be worthwhile to begin with a few introductory observations.

First, our confidence in the basic principles and blueprint formulated by Congress via the Nuclear Waste Policy Act of 1982 continues unabated. We believe that permanent geologic isolation, deep underground, in solid rock formations coupled with integral Monitored Retrievable Storage is an excellent choice.

Secondly, spent fuel and high-level waste continue to accumulate and the need for disposal grows. It seems to me that the objectives of the NWPA remain valid and urgent.

And third, thus far technical progress has been encouraging in spite of the difficulties in working with the affected parties. The key milestone was the President's approval last year of three sites for detailed study, testing and characterization.

As you evaluate new ideas or revisions to the NWPA, I am confident that improvements can be made. When or if improvements are desirable, we can hopefully find ways to adopt new approaches which do not abandon good work previously accomplished. The positive steps already taken are too important to derail, disrupt or destroy. Previous research has been validated and verified by peer reviews. In my opinion there is no objective reason to discard previous findings only to retrace the same steps anew.

For the past 25 years the national laboratories and scientific community have been researching nuclear waste disposal. It is doubtful that another decade or another billion dollars spent on research and generic studies on nuclear waste will answer the questions that must be answered. Only a comprehensive regimen of field investigations and testing can do this. And now we have finally begun.

We have known all along that locating a repository anywhere will involve tough societal and technical choices not casually resolved. It seems that we demand a strong national defense and plentiful electricity to power our factories and light our homes while insisting at the same time that the resultant waste is someone else's responsibility.

In the ebb and flow, the give and take, my primary concern is that we must be extremely cautious to not give up important and rigorous program elements mandated by the NWPA unless we are sure that we have something better.

The reason why the mission must be accomplished expeditiously and without further vacillation is obvious to the naked eye. Inventories of commercial spent nuclear fuel and of high-level waste created as national defense byproducts continue to accumulate. We can't wish them away. They are here with us today as they have been for decades. But with more than 100 large central station nuclear power reactors now in service, spent fuel storage pools are filling rapidly.

Our solution to date has been to buy time: reactor storage basins and temporary holding tanks in 100 separate locations in 33 states. It was never intended, as I understand it, that private companies in the U.S. would dispose of nuclear waste. The government has always assumed that responsibility, and yet despite $2.8 billion already paid by utilities for this disposal service, many would have us renege on prior commitments and begin anew working toward yet another solution, the future of which no one can predict.

Given the progress we have made, that just does not seem to be a fair or prudent way to do business. We would not tolerate such an approach in our own private business ventures, and we should not impose it here it seems.

I would not want to leave the impression that there is immediate danger with the status quo. The Nuclear Regulatory Commission has affirmed that the present at-reactor fuel storage pools are adequate to protect the public while we move toward a permanent solution. But the real question may be—are we determined to keep moving. I see evidence that many States, utilities, and private citizens think that we must—we must keep moving, that is. Unfortunately, there are also those who do not wish success or who would permit progress only on their own terms.

I have appended to my testimony three tables which pointedly demonstrate the national character of the dilemma, and I shall not refer to them more, but count on their being in the record, Mr. Chairman.

The problem is still squarely before us. We have a workable solution, not a perfect solution, but a workable solution. When one reviews the 40 year history of waste disposal, he is led to ask if not now, when are we going to take care of it.

I appreciate the Committee's indulgence in allowing me to digress slightly from the immediate task at hand to comment on the five bills before you for action. But I believe that this type of historical review provides helpful background as we begin to delve into specific recommendations for change.

Now if I may offer specific comments and a general summary on the bills that you have asked me to comment on, these comments are made in the context of our agreement with the congressional findings in the NWPA that permanent disposal in geologic media is the right objective for the program and that current beneficiaries have a major responsibility in putting the program in place and in paying for it.

First, if I may comment on Senator Hecht's bill, S. 1211. The stated purpose of the bill is to initiate an analysis by the National Academy of Sciences of the feasibility of reprocessing spent fuel before the Federal Government invests substantial amounts of additional rate payer funds on the deep geologic disposal of spent nuclear fuel. All site-specific work on potential repositories would be suspended while NAS studies the feasibility of reprocessing. The moratorium would freeze any further site investigations at least until the year 1990.

We would comment that when Congress considered nuclear waste disposal options, the question of reprocessing was considered. It was determined, as we understand it, that resolving the nuclear waste disposal issue would be further complicated by adding to it the many national policy issues raised by reprocessing. It was decided by the Congress to keep the two issues separate in order to move to a much needed solution on nuclear waste. We continue to believe that was the correct choice.

Another consideration is the limited design impact that reprocessing would have on a high-level waste repository. While it is indeed true that certain elements would be removed and that volume reductions would provide some benefit, the main consideration in designing the repository is the initial heat load which would only be minimally affected.

The President's October 8, 1981 statement on nuclear energy stated that reprocessing is a decision that should be made by the private sector based on market forces. At the present level of uranium prices, the reprocessing of spent nuclear fuel is not an attractive option. Meanwhile, the waste program can and will be capable of disposing of both spent fuel and high-level waste from reprocessing as the Act requires now.

Next, to your bill, Senator Hatfield, S. 1007 which, as you stated in your opening comment, has to do with providing affected State status to contiguous or nearby States.

We would comment that at the time the NWPA was under consideration, again as we understand it, the right of States to participate in the siting processing was given thorough consideration by the Congress. And it seems to us that the balance that was struck was a good one.

DOE provides under the Act a variety of opportunities for the public and officials of non-host States and tribes to participate in implementation of the NWPA. Such opportunities have included public meetings with State, tribal and local officials, public hearings on the environmental assessments, public briefings, meetings with the governors and key officials, community briefings and tours of DOE facilities without regard to whether the States are affected States.

In addition to these direct contacts, the National Conference of State Legislatures and the National Congress of American Indians have signed cooperative agreements with DOE to supplement our communication with all 50 States and 150 Indian tribal governments.

Then to Senator Hecht's S. 1141. The bill would amend the NWPA to require that spent fuel discharged from a reactor core must be stored for 50 years before it can be transported to a repository, in effect delaying deposition and disposal in a repository by about 35 years, it appears.

This bill is similar to S. 1211 in that it would impose a moratorium on disposal of nuclear waste in a repository in anticipation of eventual reprocessing. We really find no particular technical merit in the proposition, at least from the standpoint of waste disposal. Technical analysis indicates that spent fuel removed from the reactor core declines in heat by about 60 percent after five years, compared to its first year, or to about 40 percent of that original value. After 20 years the heat decline is about 90 percent from the first year, or down to about 10 percent.

A substantial amount of the spent fuel projected to be emplaced in the first repository will already have been cooled for two to three decades. In fact, for the first 10 or 15 years of operation, the fuel averages more than 25 years. Therefore, relatively little additional cooling benefit would be gained from lengthening the temporary storage time to 50 years. Moreover, the bill would permit shipment to an MRS during that 50 year cooling period but not to a repository.

Senator Hecht also has introduced S. 1428, and if I may offer a brief comment on this bill. S. 1428 would have the Offie of Energy Research, in the Department of Energy, conduct through a university consortium additional research in using the subseabed as a disposal site.

While the seabed is and has been of interest to us and we have been the major funding participant in an international study coordinated by the Nuclear Energy Agency of the OECD, we have thought it timely to have that work brought to a publication and convergence this year so we could take a look at it and see what the progress has been. That is currently being done. In fact, I believe the seabed working group met in Tokyo in the last six weeks or two months to bring that publication into shape.

Based on our most recent impressions, we have concluded that any further work ought to await the results of this publication. And therefore, we have requested no funds in 1988 and beyond and do not now have plans for further work. We would not favor conducting work under the NWPA, thus, on subseabed at this time.

And I believe the last bill that you asked us to comment on was Senator Evans' bill, jointly proposed by Senator Evans, Senator Murkowski and Senator Hecht, having to do with regional MRS facilities.

The bill would halt until the year 1998 all permanent repository activities, and in place of a repository, at least for the near term, the bill would authorize construction of four regional MRS facilities. The Secretary of the Interior would, during the suspension period, conduct a national survey and prepare a list of potential sites. DOE would conduct a survey for a need on the second geologic repository. Each of the four States or Tribes agreeing to accept an MRS would receive $100 million per year in payments from the NWPA or from the Nuclear Waste Fund. And finally, States would be given authority to regulate transportation.

The Department does not believe it would be in the national interest to suspend all work on the development of a permanent repository. Again, this is one of the key issues debated during the legislative discussions leading to the passage of NWPA. Congress determined that the legislation should be carefully crafted to insure that an MRS facility not become the de facto permanent repository. The Department, still sensing this potential, included in our MRS proposal a provision that Congress tie the opening of the MRS to receipt from the Nuclear Regulatory Commission of a construction permit to begin constructing the permanent facility.

While we have obviously not developed complete cost information on this bill, it would appear to increase the total life cycle cost by a substantial amount. The cost increase derives principally from the $100 million per year payments to each of the four States accepting an MRS.

Finally, we do not believe that delegating to 50 States the authority to individually and separately regulate transportation of nuclear materials is consistent with the need for Federal preemption in this area. The Federal Government must retain the ability it appears to us to move these materials for reasons of national security and public safety.

Mr. Chairman, this is a very brief statement on each of the bills, and perhaps that would set the stage for questions that I could respond to in more detail. And with that, I would conclude my statement.

[The prepared statement of Mr. Rusche follows:]

STATEMENT OF

BEN C. RUSCHE
DIRECTOR
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY

BEFORE THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

JULY 16, 1987

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss the Department of Energy's comments on four legislative proposals relating to nuclear waste that are under consideration by your Committee.

By way of perspective, I understand that more than 30 bills have been introduced in the 100th Congress that would affect nuclear waste storage, transportation or disposal. Each of these bills would, to one extent or another, alter the course of the U.S. nuclear disposal program presently underway. This being the case, it may be worthwhile to begin with a few introductory observations:

First, our confidence in the basic principles and blueprint formulated by Congress via the Nuclear Waste Policy Act of 1982 (NWPA) continues unabated. We believe that permanent geologic isolation, deep underground, in solid rock formations coupled with integral Monitored Retrievable Storage is an excellent choice.

Second, spent fuel and high-level waste continues to accumulate and the need for disposal grows. It seems to me that the objectives of the NWPA remain valid and urgent.

Third, thus far technical progress has been encouraging in spite of the difficulties in working with the affected parties. The key milestone was the President's approval last year of three sites for detailed study, testing and characterization.

As you evaluate new ideas or revisions to the NWPA, I am confident that improvements can be made. When or if improvements are desirable, we can hopefully find ways to adopt new approaches which do not abandon good work previously accomplished. The positive steps already taken are too important to derail, disrupt, or destroy. Previous research has been validated and verified by peer reviews. There is no objective reason to discard previous findings only to retrace the same steps anew. For the past 25 years, the national laboratories and scientific community have been researching nuclear waste disposal. It is doubtful that another decade or another billion dollars spent on research and generic studies on nuclear waste will answer the questions that must be answered. Only a comprehensive regimen of field investigations and testing can do this. And, we have finally begun.

We have known all along that locating a repository anywhere will involve tough societal and technical choices not casually resolved. We demand a strong national defense and plentiful electricity to power our factories and light our homes while insisting that the resultant waste is someone else's responsibility. Mr. Chairman, your recent proposal S. 839, co-sponsored by Senator McClure, is certainly a worthwhile attempt to make the siting of waste facilities more attractive in terms of economic benefits. In the ebb and flow, the give and take, my primary concern is that we must be extremely cautious to not give up important and rigorous program elements mandated by the NWPA unless we are sure we have something better.

The reason why the mission must be accomplished expeditiously and without further vacillation is obvious to the naked eye--inventories of commercial spent nuclear fuel and of high-level wastes created as national defense by-products, continue to accumulate. We can't wish them away; they are here with us today as they have been for decades. But with more than 100 large central station nuclear power reactors now in service, spent fuel storage pools are filling rapidly. Our solution to date has been to buy time: Reactor storage basins and temporary holding tanks in a hundred separate locations in 33 States. It was never intended that private companies in the U.S. would dispose of nuclear waste. The U.S. Government has always assumed that responsibility -- and yet, despite $2.8 billion already paid by utilities for this disposal service, many would have us renege on prior commitments and begin anew working toward yet another "solution" the future of which no one can predict. Mr. Chairman, and distinguished members of this Committee, given the progress we have made, that would just not be a fair or prudent way to do business. We would not tolerate such an approach in our own private business ventures and we should not impose it here.

I would not want to leave the impression that there is immediate danger with the status quo. The Nuclear Regulatory Commission has affirmed that the present at-reactor fuel storage pools are adequate to protect the public while we move toward a permanent solution. But, the real question may be: are we determined to keep moving? I see evidence that many States, utilities, and private citizens think that we must. Unfortunately, there are also those who do not wish us success--or who would permit progress only on their terms.

I have appended to my testimony three tables which pointedly demonstrate the national character of this dilemma:

> Thirty-three States already have growing inventories of nuclear spent fuel or will have by the year 2000.
>
> (Table 1)
>
> Four States are temporarily storing high-level wastes created by national defense programs and a former commercial reprocessing facility.
>
> (Table 2)
>
> A map showing the geographic distribution of spent fuel and high-level waste.
>
> (Table 3)

The problem is still squarely before us. We have a workable solution--not perfect but workable. When one reviews the 40 year history of waste disposal, he is led to ask if not now, when?

I appreciate the Committee's indulgence in allowing me to digress slightly from the immediate task at hand--to comment on the four bills before you for action. But, I believe that this type of historical review provides helpful background as we begin to delve into specific recommendations for change.

Now, I am pleased to offer the Department's general summary and observations on the pending bills:

S. 1211 NUCLEAR WASTE REPROCESSING STUDY ACT OF 1987

Sponsor: Senator Hecht

Key Provisions:

The stated purpose of this bill is to initiate an analysis by the National Academy of Sciences (NAS) of the feasibility of reprocessing spent fuel "before the Federal Government invests substantial amounts of additional ratepayer funds on the deep geologic disposal of spent nuclear fuel." All site specific work on potential repositories would be suspended while NAS studies the feasibility of reprocessing. The moratorium would freeze any further site investigations until the year 1990.

Commentary:

When Congress considered nuclear waste disposal options, the question of reprocessing was considered. It was determined that resolving the nuclear waste disposal issue would be further complicated by adding to it the many national policy issues raised by reprocessing. It was decided by the Congress to keep the two issues separate in order to move to a much needed solution on nuclear waste. We continue to believe that was the correct choice.

Another consideration is the limited design impact that reprocessing would have on a high-level waste repository. While it is indeed true that certain elements would be removed and that volume reductions would provide some benefit, the main consideration in designing the repository is heat load which would be only minimally affected. The President's October 8, 1981, statement on nuclear energy stated that reprocessing is a decision that should be made by the private sector based on market forces. At the present level of uranium prices, the reprocessing of spent nuclear fuel is not an attractive option. Meanwhile, the waste program can and will be capable of disposing of both spent fuel and high-level waste from reprocessing.

S. 1007 TO AMEND THE NUCLEAR WASTE POLICY ACT OF 1982

Sponsor: Senator Hatfield

Key Provisions:

Any State lying contiguous to a major river or waterway or above an underground aquifer, adjacent to, or above which a repository is proposed to be located would have all the same rights and opportunities to participate in the site selection, review and approval process established by the NWPA as the State in which the repository is proposed to be located.

COMMENTARY:

At the time NWPA was under consideration, the rights of States to participate in the siting process was given thorough consideration by the Congress. We believe that the balance that was struck is a good one.

DOE provides a variety of opportunities for the public and officials of non-host States and Tribes to participate in implementation of the NWPA. Such opportunities have included public meetings with State, Tribal and local officials, public hearings on the Environmental Assessments, public briefings, meetings with Governors and key officials, community briefings and tours of DOE facilities. In addition to these direct contacts, the National Conference of State Legislatures (NCSL) and the National Congress of American Indians (NCAI) have signed cooperative agreements with DOE to supplement our communication with all 50 States and 150 Indian Tribal governments.

S. 1141 NUCLEAR ENERGY WASTE POLICY ACT OF 1987

Sponsor: Senator Hecht

Key Provisions:

The bill would amend the NWPA to require that spent fuel discharged from a reactor core must be stored for 50 years before it can be transported to a repository.

Commentary:

This bill is similar to S. 1211 in that it would impose a moratorium on disposal of nuclear waste in a repository in anticipation of eventual reprocessing. We can find no particular technical merit in the proposition. Technical analysis indicates that spent fuel removed from the reactor core declines in heat by 60 percent after five years. After 25 years, the heat decline is about 90 percent. A substantial amount of the spent fuel projected to be emplaced in the first repository will already have been cooled for two to three decades. Therefore, relatively little additional cooling benefit would be gained from lengthening the temporary storage time to 50 years. Moreover, the bill would permit shipment to an MRS during the 50 year cooling period-- but not to a repository.

S. 1266 HIGH-LEVEL RADIOACTIVE WASTE STORAGE ACT OF 1987

Sponsors: Senators Evans, Murkowski, Hecht

Key Provisions:

The bill would halt until the year 1998 all permanent repository activities (siting, construction, planning and any other activity). In place of a repository, the bill would authorize construction of four regional MRS facilities. The Secretary of Interior would, during the suspension period, conduct a national survey and prepare a list of potential repository sites. DOE would conduct a survey on the need for a second geologic repository. Each of the four States or Tribes agreeing to accept an MRS would receive $100 million per year in payments from the Nuclear Waste Fund. States would be given authority to regulate transportation.

Commentary:

The Department does not believe it would be in the national interest to suspend all work on the development of a permanent repository. Again, this was one of the key issues debated during the legislative discussions leading to passage of NWPA. Congress determined that the legislation should be carefully crafted to insure that an MRS facility not become the defacto permanent repository. The

Department, still sensing this potential, included in the MRS proposal a provision that Congress tie the opening of the MRS to receipt from the Nuclear Regulatory Commission of a construction permit to begin constructing the permanent facility. While we have obviously not developed complete cost information on this bill, it would appear to increase total system life-cycle costs by $24 billion to a new level of $56 billion. The cost increase derives principally from the $100 million per year payments to each of the four States accepting a MRS. Finally, we do not believe that delegating to 50 States the authority to individually and separately regulate transportation of nuclear materials is consistent with the need for Federal pre-emption. The Federal Government must retain the ability to move these materials for reasons of national security and public safety.

In conclusion, Mr. Chairman, we see no clear-cut value to these four bills and certainly see that some of the features are unnecessary or unwarranted. With the prospects for revisions in over 30 bills, we believe that great care must be taken to assure that net improvement is made to the NWPA if changes are to be made.

Table 1: Existing and Projected Inventories of Spent Nuclear Fuel, by State: Years 1985 and 2000
(In hundreds of units)

State	Spent Nuclear Fuel 1985 (MTU) (1)	2000 (MTU) (2)	1985 (M³) (3)	2000 (M³) (4)
Alabama	9	29	4	11
Arizona	0	10	0	4
Arkansas	3	8	1	3
California	3	18	1	7
Connecticut	7	18	3	7
Florida	7	20	3	8
Georgia	3	15	1	6
Illinois	19	58	8	23
Iowa	1	3	*	1
Kansas	0	3	0	1
Louisiana	0	7	0	3
Maine	3	5	1	2
Maryland	4	9	2	4
Massachusetts	3	6	1	2
Michigan	7	23	3	9
Minnesota	5	11	2	4
Mississippi	0	8	0	3
Missouri	0	3	0	1
Nebraska	3	7	1	3
New Hampshire	0	5	0	2
New Jersey	4	18	2	7
New York	11	29	5	11
North Carolina	5	19	2	7
Ohio	1	10	*	4
Oregon	2	5	1	2
Pennsylvania	8	39	4	15
South Carolina	7	25	3	10
Tennessee	2	16	1	6
Texas	0	13	0	5
Vermont	2	4	1	2
Virginia	6	16	3	6
Washington	*	9	*	4
Wisconsin	4	10	2	4
TOTAL	129	479	55	187

MTU metric ton of uranium.
M³ cubic meters.
* less than .5.

Source: Pacific Northwest Laboratory, Reactor Specific Spent Fuel Discharge Projections: 1984 to 2020 (PNL-5396), April 1985. The data differ slightly from the data contained in the DOE/RW 0006 report because of different assumptions about on-line availability of nuclear power plants.

Table 2: Existing and Projected National Inventory of High-Level Radioactive Waste by Source, by State: 1985 and 2000

(In thousands of cubic meters)

Source/State	High-Level Radioactive Waste 1985	High-Level Radioactive Waste 2000
Defense		
Idaho	10.1	14.2
South Carolina[1]	116.6	67.1
Washington	227.8	248.7
Commercial		
New York[2]	2.3	0.2
TOTAL	356.8	330.2

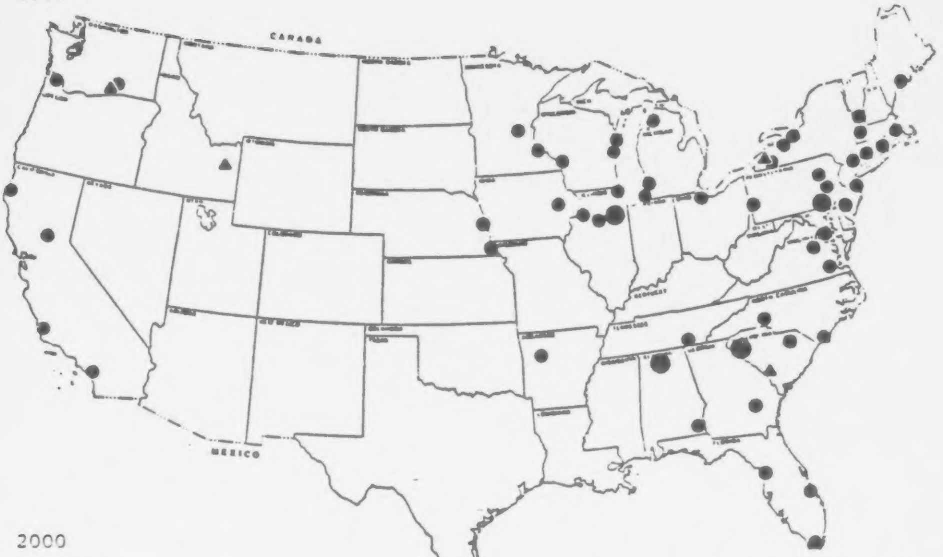
[1] Decline in volume due to DOE's program to immobilize high-level waste for ultimate geologic disposal.

[2] High-level waste will be converted to a form suitable for geologic disposal.

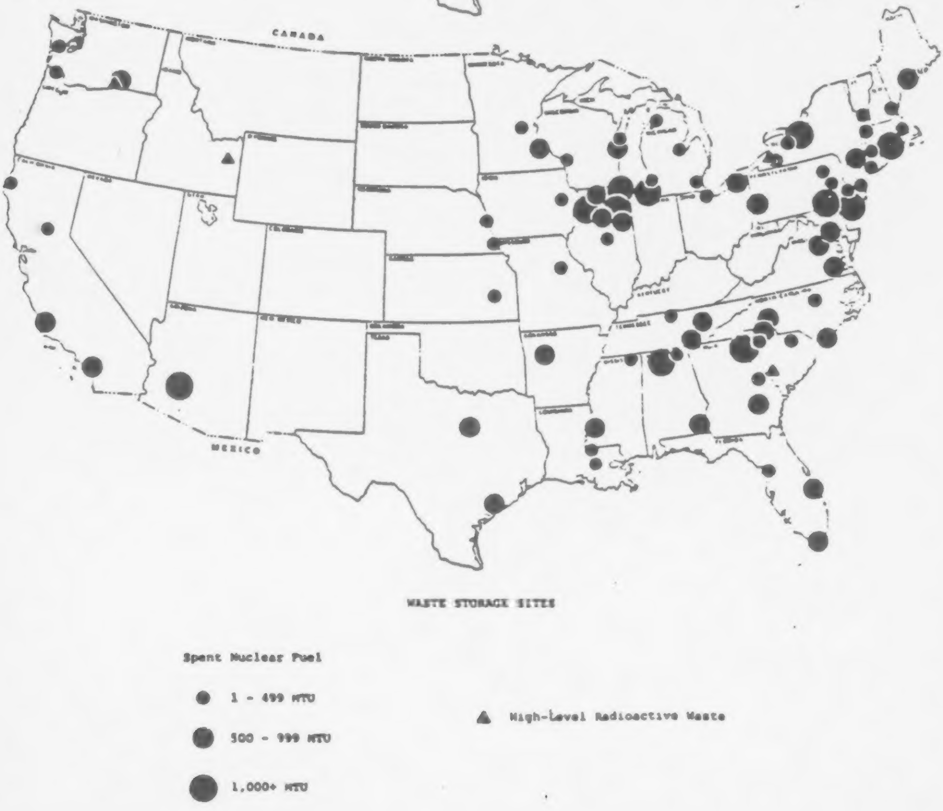
Source: DOE, Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics (DOE/RW-0006, Rev. 1), December 1985.

Table 3
THE GEOGRAPHIC DISTRIBUTION OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

1985


CANADA
MEXICO

2000


CANADA
MEXICO
WASTE STORAGE SITES
Spent Nuclear Fuel
● 1 - 499 MTU
● 500 - 999 MTU
● 1,000+ MTU
▲ High-Level Radioactive Waste

Senator **Hatfield**. Thank you very much, Mr. Rusche. Before the Chair propounds a number of questions for you, I would inquire as to whether the Senator from Washington State, Senator Evans has an opening statement he wishes to make.

STATEMENT OF HON. DANIEL J. EVANS, A U.S. SENATOR FROM THE STATE OF WASHINGTON

Senator **Evans**. Thank you, Mr. Chairman. I ask unanimous consent that my full opening statement be placed into the record. And let me only read at this time one paragraph of that opening statement and perhaps I will fold the rest of it into my time when I question Mr. Rusche.

In spite of the optimistic reports of the Department of Energy and the testimony just given by Mr. Rusche, I continue to believe that there are serious problems with the nuclear waste program in this country. There are dozens of lawsuits pending in the Ninth Circuit Court of Appeals and an increasingly wide gulf separates the Department of Energy and the affected states and tribes.

The House of Representatives has again voted to prohibit exploratory shaft drilling at first repository sites and a moratorium on site-specific work at the second repository.

And most recently one of the fathers of the Nuclear Waste Policy Act itself, Congressman Mo Udall, argued that five years after passing the NWPA, "After billions of dollars of the rate payers' money have been collected and hundreds of millions of dollars spent, the program is in ruins and our goal of siting a repository seems further away than ever."

Mr. Chairman, Mr. Rusche, I hardly think that comports with the rather optimistic view and stay-the-course testimony that you have just given. If Congressman Udall believes the program is in ruins, knowing his position in the House of Representatives and the admiration with which he is held by his colleagues, believe me, sir, the program is in ruins because you are not likely to get congressional approval for continuing or staying the course unless there is a radical change in direction by Congressman Udall and others.

Mr. Chairman, with that I will hold any further statement until my question time.

[The prepared statement of Senator Evans follows:]

Statement of Senator Daniel J. Evans

Hearings on S. 1007, S.1141, S. 1211 and S. 1266

July 16, 1987

I appreciate the cooperation of the Chairman of the Committee, Senator Johnston, in scheduling a hearing on these important pieces of legislation, each of which would make substantial changes to our current nuclear waste policy.

This is certainly not a new issue for this Committee. We have had representatives from the Department of Energy, the utilities, and affected states and Indian Tribes come before us on many occasions to tell the Committee what is or is not wrong with the nation's nuclear waste program. I am also aware that there are a wide variety of opinions held by the members of this Committee on the current status of the program -- a diversity which is reflected in the number of bills which members of the Committee have introduced on this issue.

Despite the optimistic reports of the Department of Energy, I continue to believe there are serious problems with the nuclear waste program in this country. There are dozens of lawsuits pending in the 9th Circuit Court of Appeals. An increasingly wide gulf separates the Department of Energy and the affected states and tribes. The House of Representatives has again voted to prohibit exploratory shaft drilling at first repository sites and establish a moratorium on site specific work on the second repository. And most recently, one of the "fathers" of the Nuclear Waste Policy Act (NWPA), Congressman Mo Udall, argued that five years after passing the NWPA, "after billions of dollars of the ratepayers money have been collected and hundreds of millions of dollars spent, the program is in ruins and our goal of siting a repository seems further away than ever."

Yet we simply cannot throw up our hands, and refuse to face up to these problems. Spent fuel rods continue to fill cooling ponds at commercial reactors across the country. Defense wastes continue to accumulate in South Carolina and in my own state of Washington. Concern for public safety and the environment made it possible in 1982 to fashion a compromise bill designed to provide a solution to the the nuclear waste disposal issue. In 1987, those concerns are just as strong. It is high time that we turn away from the "US versus THEM" mentality which has pitted state against state and resulted in a growing rift between the East and West on this issue.

I have introduced, along with Senator Hecht and Senator Murkowski of the Committee, S. 1266, which I believe will get the overall waste disposal program back on track. The bill authorizes the development of four regional Monitored Retrievable Storage (MRS) facilities to provide safe interim storage for nuclear waste generated within each of the four regions. This interim storage gives us much-needed time to restore technical credibility to the repository program, and consequently, build public confidence in the federal government's ability to dispose of spent fuel efficiently and safely. In addition, the additional storage time will allow much of the heat and short-lived radionuclides to decay away which could reduce the cost of the first repository, or could make a second repository unnecessary altogether.

I know that some members of this Committee, as well as representatives from utilities and the Administration have expressed strong reservations over making any fundamental changes in the current program, believing that this would further disrupt an already-troubled program. Yet at this point, without a significant mid-course correction to the Nuclear Waste Policy Act, I have serious doubts whether a repository will ever be successfully sited, constructed and operated, without long delays and skyrocketing costs. I am concerned that the Department's ability to live up to its contractual obligations to take title to spent fuel rods at commercial reactors across the country by 1998 has been seriously jeopardized, and without substantial improvements in resolving this issue, we are likely to see legal challenges to the NRC's ruling on waste confidence.

It is time for Congress to come together to fashion a legislative consensus solution to the nuclear waste issue. I am aware that Chairman Johnston has recently submitted legislation designed to correct flaws in the nuclear waste program, and I know he is committed to moving ahead responsibly to permanently dispose of the nation's nuclear waste. I stand ready to work with him and others on the Committee to tackle this complex and difficult issue. I believe that we ought to take advantage of the interim storage resource presented by MRS, just as the French and Swedish now do in their nuclear waste disposal program. I fully agree, however, that MRS should not be a replacement for the repository program, and my bill maintains the repository as the ultimate disposal option. S. 1266 is intended to give us the time to make sure that we have a safe and cost-effective repository program, one to which the public can pledge its confidence.

I am convinced that it is indeed possible to develop an effective and acceptable solution to our current problems, and I believe that that this Committee can take the lead in forging a solution to this this politically difficult and volatile issue. I believe S. 1266 offers an effective and workable alternative, one which provides a effective solution to this complex problem. I stand ready to work with the Chairman and other members of the Committee to get the program moving again in the right direction. It is time to get started.

Senator **Hatfield**. I thank the Senator.

Senator Hecht, I believe your statement is now in your possession. Do you care to make your opening statement?

STATEMENT OF HON. CHIC HECHT, A U.S. SENATOR FROM THE STATE OF NEVADA

Senator **Hecht**. Thank you, Mr. Chairman, and thank you for holding these hearings today.

Nuclear waste is an issue that is obviously very important to me and to the folks back home in Nevada. And that is why I have introduced the legislation to be considered here today to make certain that the disposal of this Nation's high-level nuclear waste is handled in the safest, most effective, most efficient manner possible.

This issue and the legislation to address it is so important to me that I cancelled longstanding plans to attend the ceremonies in Philadelphia today to honor the 200th anniversary of the Constitution. I had hoped I would be able to attend. But to me the rights, freedoms and responsibilities the Constitution provides to the citizens of this country are far more important than the document itself. To take part in celebrating the Constitution and at the same time ignore congressional hearings on a vital issue such as nuclear waste, which concerns safety, energy independence and even national security for generations of Americans to come, would be to ignore my duties as a Senator and to do a grave disservice to the Constitution.

Mr. Chairman, I will follow up on my remarks with Mr. Rusche at a later time.

[The prepared statement of Senator Hecht follows:]

STATEMENT OF SENATOR HECHT

Mr. Chairman, thank you for holding these hearings today. Nuclear waste is an issue that is obviously very important to me, and to the folks back home in Nevada.

This is why I have introduced the legislation to be considered here today, to make certain that the disposal of this nation's high-level nuclear waste is handled in the safest, most effective, most efficient manner possible. It's become clear to this Senator that some of the bureaucrats at DOE don't necessarily share these goals.

This issue, and the legislation to address it, is so important to me that I cancelled long-standing plans to attend the ceremonies in Philadelphia today to honor the 200th anniversary of the Constitution. I had hoped I would be able to attend.

But to me, the rights, freedoms, and responsibilities the Constitution provides to the citizens of this country are far more important than the document itself. To take part in celebrating the Constitution, and at the same time ignore Congressional hearings on a vital issue such as nuclear waste -- which concerns safety, energy independence, and even national security for generations of Americans to come -- would be to ignore my duty as a Senator, and to do a grave disservice to the Constitution.

Senator HATFIELD. All right. Thank you, Senator Hecht.

Senator Bingaman, do you have an opening statement?

Senator BINGAMAN. I did not. I am glad to be here and look forward to the questions and testimony.

Senator HATFIELD. Thank you very much for your presence.

Mr. Rusche, in the 1987 appropriations continuing resolution, you recall that we had language that specifically told the Department of Energy that exploratory shaft drilling is not authorized or would not be permitted at Hanford.

Now, I understand that DOE has initiated a study to evaluate the engineering aspects of sinking a shaft to what is defined as a first basalt flow. This would be about a 600-foot hole, as I have it interpreted to me.

And my question to you, does this not constitute an exploratory shaft, or is the DOE to imitate Dorothy Parker telling us a shaft is not a shaft, that is a shaft is not a shaft?

Mr. RUSCHE. Senator, Mr. Chairman, I think a shaft is a shaft for sure. But I believe that the prohibition in the 1987 continuing resolution was sinking or drilling a shaft. We have made no attempt, have no plans, to drill. And the reference you make is to study as to whether such a course, when we were permitted to drill a shaft or authorized and funds are appropriated, whether that might be an appropriate early course.

I must just elaborate one step further. We have looked for and have now reached agreement with the affected States and Tribes—and in fact, your State participated. We have looked for procedures which would give us as early indication as we could as to whether there were conditions at the site which might disqualify the site. To that end, we did reach formal agreement with those parties and with the NRC to conduct what we called a large-scale hydrology pumping test.

That test we would want to have well under way before we even entertain the thought of sinking a shaft even if we had authority. And that test is several months to perhaps a year, year and a half, in duration. So, I believe we have been faithful to the prohibition that was included in the 1987 Continuing Resolution.

Senator HATFIELD. So, then I understand you to say that you are merely contemplating and meditating and studying the possibility.

Mr. RUSCHE. Indeed.

Senator HATFIELD. How many people in your agency are devoting their time and energies to this particular study?

Mr. RUSCHE. I honestly could not tell you.

Senator HATFIELD. Could you provide that for the record?

Mr. RUSCHE. Sure.

Senator HATFIELD. With about an estimate of how much money is being expended for this fruitless study.

Mr. RUSCHE. I would be glad to, and in fact, I would want to be very straightforward with you that given that prohibition, we understood that to be a 1987 prohibition. And if we were to interpret that to be a forever prohibition, then the program should have stopped last year. If you take the other view, which we took, that we would eventually receive the approval of Congress to sink such a shaft, we have many other efforts underway before such shaft work. We have the development of a site characterization plan which constitutes the bulk of our effort which depends almost exclusively on having the shaft sunk.

Senator **Hatfield**. I would like the figure and the numbers of how many people are devoting their time and their energies to this kind of study.

Mr. **Rusche**. To the 600 foot consideration. I want to be sure I will give you the right information.

Senator **Hatfield**. And make it as narrow or broad or give me a range.

Mr. **Rusche**. We will describe the context as we understand the question and provide that.

Senator **Hatfield**. In fact, I would like a range rather than the specifics.

Mr. **Rusche**. Sir?

Senator **Hatfield**. I would like a range rather than just a specific figure.

Mr. **Rusche**. Sure.

Senator **Hatfield**. So that would give us leeway.

Mr. **Rusche**. Certainly.

[The information follows:]

The geohydrology testing program at Hanford has been precisely defined only for those tests required prior to drilling the exploratory shafts. Four hydraulic tests have been identified for this period. The costs and manpower required to perform these tests, including drilling and constructing piezometers necessary to obtain pre-test baseline information and to monitor test results are detailed below.

	FY88 COST (000 of $)	MAN YEARS	FY89 COST (000 of $)	MAN YEARS
1 DESIGN	56	0.56	50	0.50
2 DRILLING & PIEZOMETER INSTALLATION	11368	24.60	3218	8.20
3 LHS TESTING	315	3.50	1530	17.00
4 WELL AND PIEZOMETER MONITORING	2000	25.00	2160	27
5 PRE DRILLING ACTIVITIES	1700	17.00	2350	23.50
6 ANALYSIS OF DATA	--	--	400	4.00
TOTAL	15439	70.66	9708	80.2

Total FY88/89

Costs 25,147

Man years 150.86

Senator HATFIELD. Now, Mr. Rusche, there is strong evidence that the acquisition of much needed data could be compromised by the sinking of any shaft. Is this a valid observation?

Mr. RUSCHE. Indeed it is. In fact, it is the primary motivation for the large-scale hydraulic test that I just described for you a moment ago.

Senator HATFIELD. How would DOE deal with this established fact—how would you confirm the suitability or the non-suitability of any site if data is being destroyed in the actual drilling of a shaft?

Mr. RUSCHE. As I attempted to just describe with the large-scale hydraulic test, the course that one follows from a scientific standpoint is to attempt to determine what data might be affected by subsequent activities and to conduct in advance of those activities the necessary procedures to gain the data which might otherwise be lost in the subsequent activity. That is precisely the reason the large-scale hydraulic test has been agreed to and is under way so that the data that might be affected by the shaft would have been acquired before the shaft is sunk.

Senator HATFIELD. Are you familiar with the Atlantic Richfield Hanford Company offsite iodine 129 contamination issue?

Mr. RUSCHE. I am aware that there was a subject. It is not directly related to our program, but I am somewhat conversant with it. I would be glad to try to respond to a question.

Senator HATFIELD. In this particular study to which I reference—I believe in 1973 that it was made by the Atlantic Richfield Hanford Company—this was what they refer to as an offsite iodine 129 contamination outside of the confined aquifer at Hanford. As I read this particular study, the report indicates that there is evidence that traces of iodine 129 have been found on the opposite side of the Columbia River from the present nuclear facilities in what is referred to as the 200 area operations.

Obviously, this has certain implications of the suitability of the Hanford site as a repository to me, as I read this. Would you care to comment on how you would see this particular study in light of its findings?

Mr. RUSCHE. Mr. Chairman, we would want to look at all the data that we could get our hands on, and that certainly is relevant data.

I would note, however, that the data and the circumstances I believe were related to a surface-based release or phenomenon, and although that is useful data, it does not necessarily relate to or correlate with the kinds of circumstances that might exist at depth in the lower basaltic flows which are considering for a repository. I think the only way one can tell for sure is to conduct those experiments. We certainly would not ignore the data and would have it well considered within our evaluation.

Senator HATFIELD. As you know, scientists are planning to monitor this particular situation here.

Mr. RUSCHE. Indeed.

Senator HATFIELD. And I am also curious why the DOE did not reference this document in its May 1986 environmental assessment of the Hanford site.

Mr. **Rusche**. To be perfectly frank with you, I would have to look and see what the circumstances were. I would be glad to give you an answer.

My recollection is somewhat as I just have said. That data is not particularly relevant to the deep basaltic flow considerations which bear on the evaluation of the suitability of that flow for a repository. Those experiences have emerged as a result of other activities conducted on the site, and I suspect that that is the reason. But I would be glad to give you a more extensive answer if you would permit me.

[The information follows:]

The Environmental Assessment (EA) for the Hanford site does not reference the Atlantic Richfield Study of 1973; however, the 1976 ARCO study, Geohydrologic Study of the West Lake Basin, ARH-CD-775, by Gephart, et al, is referenced.

Pages 3-112 and 3-113 (attached) of the Hanford EA contain a synopsis of iodine-129 data for the Hanford site. This synopsis addresses the information available at the time of writing. Information from the ARCO study cited above is included in the synopsis.

(Schwab et al., 1979; Gephart et al., 1979; Fecht et al., 1984) and hydrochemical analyses conducted (Early et al., 1985). A total of 125 springs or suspected spring locations were identified in Schwab et al. (1979) over the 470-square-kilometer (182-square-mile) area studied. Springs occur where natural recharge from precipitation infiltrates along rock having higher hydraulic conductivity until a zone of lower conductivity is encountered. Such a zone may be a basalt flow interior or clays in a sedimentary interbed. Some water then moves in the direction of bedrock dip or along a geologic feature of higher hydraulic conductivity until it reaches land surface. Most springs in the Rattlesnake Mountain area appear to discharge from basalt flow tops and interbeds and along structural features. Springs inventoried occur across elevations of 320 to 1,000 meters (1,050 to 3,300 feet). Total spring discharges increase with decreasing elevations, reaching a peak discharge of approximately 380 liters (100 gallons) per minute between the elevations of 490 and 610 meters (1,600 and 2,000 feet) for the area studied. Alluvial sediment covers any spring discharges below the approximate 320-meter (1,000-foot) elevation along Rattlesnake Mountain.

Geochemically, spring waters are of a calcium-sodium-bicarbonate type with low total dissolved solids (approximately 200 to 400 milligrams per liter) (Early et al., 1985). Compositionally, these waters are similar to shallow local ground waters (unconfined aquifer and upper Saddle Mountains Basalt). However, they are readily distinguishable from waters of the lower Saddle Mountains (Mabton interbed) and the Wanapum and Grande Ronde Basalts, which are of sodium-bicarbonate to sodium-chloride-bicarbonate (or sodium-chloride-sulfate) type. Currently, there is no evidence suggesting these spring waters contain any significant component of deeper ground water, an occurrence that would be recognized, for example, by elevated concentrations of fluoride and chloride in spring samples.

The observed abundance of naturally occurring, cosmogenically produced, radioactive isotopes such as tritium (half-life = 12.3 years) and carbon-14 (half-life = 5,570 years) tend to support the hypothesis that these spring waters have recharged recently. For example, tritium concentrations range from 0 to 7 tritium units. Furthermore, carbon-14 content ranges from approximately 20 to over 100 percent modern. Both observations are indicative of relatively young waters with evidence of some recent meteoric inputs (post-mid-1950's). The possibility of contamination of these waters with modern carbon and hydrogen through exposure in the spring pools cannot be dismissed. However, most springs sampled had flow rates on the order of 20 to 55 liters (5 to 15 gallons) per minute, and samples were collected as close to the source of the spring as practical. Therefore, it is unlikely that observed concentrations of carbon-14 and tritium resulted from atmospheric contamination.

Iodine-129 and tritium have been detected in confined ground-water zones in the Saddle Mountains Basalt beneath the Hanford Site. Two areas have above-background concentrations of iodine-129. These are in the vicinity of West Lake and Gable Mountain Pond and at one borehole DB-7, located approximately 20 kilometers (12 miles) to the southeast near the Yakima River (see Fig. 3-24 and 3-34).

In the West Lake-Gable Mountain Pond area, the basalts were uplifted along the eastern extension of the Umtanum Ridge-Gable Mountain structure and then eroded by postglacial floodwaters and the ancestral Columbia River. Hydraulic intercommunication now exists between the upper confined and unconfined aquifers in this area. Because cooling waters from chemical processing plants are discharged into ponds near the 200 East Area on the Hanford Site, hydraulic heads in the unconfined aquifer near these discharge areas have at times exceeded those in the shallow basalts. This created a hydraulic driving force for transporting low-level contaminated water from the unconfined aquifer into the uppermost basalt aquifer(s) (Gephart et al., 1976; Graham et al., 1984). The presence of iodine-129 and tritium in the Saddle Mountains Basalt is thought to result from past water exchange. Reported concentrations of iodine-129 in the Rattlesnake Ridge interbed (see Fig. 3-6) range from near the detection limit of 4×10^{-6} picocurie per liter to a maximum of 4×10^{-2} picocurie per liter near liquid waste-disposal sites (Graham et al., 1984; Strait and Moore, 1982; Gephart et al., 1976).

At borehole DB-7 near the horn of the Yakima River, iodine-129 in the Mabton interbed was detected at concentrations of approximately 3×10^{-4} picocurie per liter. This concentration appears higher than at other ground-water sampling points away from waste-disposal areas. However, data given in Early et al. (1985) show the absence of tritium (less than 0.1 tritium unit) in any wells monitoring the Mabton interbed outside the 200 Areas, including borehole DB-7. This implies that the source of slightly elevated iodine-129 concentrations in borehole DB-7 could not be the result of aquifer transport originating from either precipitation or subsurface movement from radioactive liquid waste-disposal sites farther north. The source of iodine-129 in borehole DB-7 is unknown and will be addressed by the U.S. Department of Energy. Studies are under way to examine the sampling integrity of borehole DB-7, which may influence the quality of water samples taken. (The analytical and ground-water sampling techniques used for iodine-129 detection are described in Brauer and Rieck (1973).)

Iodine-129 concentrations of 6×10^{-5} picocurie per liter and 2×10^{-2} to 8×10^{-3} picocurie per liter have been detected in the Columbia River and Hanford 300 Area rain water, respectively. Price et al. (1985) reported that iodine-129 concentrations in the Columbia River in 1984 ranged from 1.2×10^{-5} picocurie per liter upstream from the Hanford Site to 7.4×10^{-5} picocurie per liter downstream from the Hanford Site. The U.S. Department of Energy concentration guideline for iodine-129 is 60 picocuries per liter (DOE, 1981). The U.S. Environmental Protection Agency drinking water standard is 1.0 picocurie per liter (EPA, 1976).

The U.S. Department of Energy has solicited extensive outside critiques of the hydrochemistry program (e.g., Bentley, 1982; LBL, 1982; PNL, 1983). The purpose of these reviews is to enhance data interpretation, as well as analytical and sampling procedures, through consultation. Aspects of the reviews are being considered for incorporation into future hydrochemistry plans.

Senator HATFIELD. I would like to have you comment on that because, as you know, the contamination discovered will not disappear for thousands of years, according to the best scientific information I have. It would seem to me that in your activity there in exploration and so forth it might raise a question of a design that would not be able to tell the new contamination from the old contamination unless you have got some kind of a very careful analysis of that contamination of iodine 129.

Now, let me ask you. As I understand, you are required to take into consideration in any high-level waste siting standards what is called the natural resources potential at a site. Again, my understanding is that exploration at Hanford has shown natural gas or methane in the groundwater.

What does this indicate to you as far as potential adverse conditions in relation to this provision of adverse impact on natural resources?

Mr. RUSCHE. You do correctly state that our siting guidelines require us to consider natural resource potential value at a site. The information you refer to would, indeed, be information we would have already given consideration to as to its relative value and its importance in the context of the use of the site for any of several purposes, one of which would be the repository, another of which would be the extraction of such natural resources. So, a body would want to obtain some quantification of the potential to make a judgment in that regard.

The existence of methane per se in any quantity would not in itself lead one to a conclusion that the site was in conflict with natural resource potential.

Senator HATFIELD. It would not.

Mr. RUSCHE. It would not.

Senator HATFIELD. Why?

Mr. RUSCHE. Because the quantity might be relatively small. In fact, in many water-bearing strata that have come in contact with organic materials over geologic time, they do contain methane either absorbed or free, generally absorbed methane as a result of decay of the organic material over geologic time. So, it is a matter of judgment and evaluation, but by no means a binary kind of yes or no answer.

Senator HATFIELD. You are saying that that fact would not disqualify the site per se. It would depend on the quantity?

Mr. RUSCHE. The quantity, the value and accessibility and many features of that sort.

Senator HATFIELD. Mr. Rusche, if the Department were asked today, using the current available information to make recommendation, which of the three sites is most likely for a repository? Which one would you name first? Which one would you name second? Which one would you name third?

Mr. RUSCHE. Sir, I would be inclined to say that we believe that the three taken together provide a good ensemble to search for a final site and I would not at this time be able to rank the sites in that order.

We attempted to make that point when we published the multiattribute utilities study. You can rank them 1, 2, 3 by many different ways. And taken in the aggregate, I think it is just premature to try to make that kind of judgment.

Senator HATFIELD. Do you have data in your possession that would indicate a ranking?

Mr. RUSCHE. Oh, we have published documents which show the ranking by perhaps 14 different sets of parameters. And they rank from the Hanford site being first to the Hanford site being third. Other parameters say the Nevada site is first and others say it is third. The Texas site, as I recall, may be more often first or second, but may not as many times be first.

And so, when you try to aggregate these, we face a very real question of analysis. We attempted to address this issue as best we could in what I believe has been the best multiattribute decision study ever done. And that provides these rankings.

Senator HATFIELD. And there is no priority, one source of measurement as against another source of measurement, that you could take three coins and odd man out could be just as easy a way to select the ranking of these three sites?

Mr. RUSCHE. Based on the data we have today, that is a fair statement. Now, we are going to continue to accumulate data, and I referred two or three times in our dialogue this morning to the large-scale hydraulic test. And that piece of data perhaps has the potential for providing the earliest indication of something that might disqualify the site.

Senator HATFIELD. Well, then as I understand, Mr. Rusche, if Congress asked you today to give us the first ranking, the first choice, you just would not be able to do that.

Mr. RUSCHE. Based on the data today, we think all three sites are suitable. Now, if you passed it along, and——

Senator HATFIELD. We are not going to build sites. If we asked you for one site today, to give us a recommendation based on your available data, are you telling me you are not qualified to give us a specific response to that question on the basis of your data today?

Mr. RUSCHE. Whether I am qualified or not, I would——

Senator HATFIELD. Professionally you are qualified, but you are not able to give us such a statement?

Mr. RUSCHE. I suspect that you could prescribe a set of conditions or a context very specifically, and in that context we could make such a ranking given the limited data that we have got. And if you gave me the precise context, then I would be prepared to, and if you directed me to, give you one. I think it is premature to do that at this stage.

Senator HATFIELD. So, you have data that I suppose would be considered both as a plus and minus for every one of these sites.

Mr. RUSCHE. Indeed, we do.

Senator HATFIELD. Would you give me the data that you have now that would disqualify Hanford from becoming a repository, the negative data that you have acquired in your investigation? Could you do that?

Mr. RUSCHE. Yes, sir. But if I may be specific, disqualify has a very specific connotation under the siting guidelines. As of the moment, none of the data we have suggests that the site should be disqualified. The questions that we are trying to investigate now are which of the sites is preferable in the light of the fact that it is not disqualified.

I would be glad to provide the references to you, and they are extensive.

Senator **Hatfield**. Yes. For the record, I would like to see what you would list on the minus side of Hanford.

Mr. **Rusche**. Indeed. We would be glad to provide that for you.

Senator **Hatfield**. Do you believe that sufficient data exists that would allow you to construct a hierarchy representing the most well-suited repository, now taking it from the other side, of these three? Could you give us the positive data——

Mr. **Rusche**. Indeed.

Senator **Hatfield** [continuing]. That would best qualify——

Mr. **Rusche**. Indeed.

Senator **Hatfield** [continuing]. Three sites, all separate, and the negative for all three?

Mr. **Rusche**. Sure.

Senator **Hatfield**. Let's make it complete.

Mr. **Rusche**. We have done this in a document that is called the multi-attribute utility study. And that will be my primary reference to you which does this as best we know how.

[Subsequent to the hearings the committee received the following:]

Several recent DOE publications present detailed, extensive information on the positive and negative data on the three sites recommended for site characterization. Because of their length and complexity, these publications are not easily summarized. Instead, we briefly describe their contents and include them as enclosures to this response.

The environmental assessment for each site contains a number of evaluations and descriptions listed in the Nuclear Waste Policy Act of 1982, including findings on all the favorable and potentially adverse conditions in the DOE siting guidelines (see Chapter 6 of assessments). In addition, a chapter common to all the environmental assessments (Chapter 7) contains a comparative evaluation of the sites nominated for characterization.

To help determine which three sites appeared most favorable for recommendation for characterization, the data and evaluations reported or referenced in the environmental assessments were further analyzed using a formal method of analysis known as multiattribute utility analysis. This well-established technique explicitly addresses the uncertainties and value judgments that are part of all siting problems. The multiattribute methodology was independently reviewed by a panel of the National Academy of Sciences, and the analysis is documented in detail in a report entitled Multiattribute Utility Analysis of Sites Nominated for Characterization for the First Radioactive-Waste Repository (DOE/RW-0074, May 1986).

(Committee Note.--The referenced documents have been retained in Committee files.)

Senator HATFIELD. One last question. What would be your attitude? I read your testimony, and I did not get a clear picture of an endorsement of my bill. [Laughter.]

So, I suppose what I would like to ask you is if it were restricted just to Oregon, how would you feel about the bill then?

Mr. RUSCHE. We would always be inclined, directed and faithful to follow the Congress in its direction. I think, as I have tried to say in my brief summary, that it is not necessary. We have with your State I think developed an appropriate relationship which serves its interests. I think as the issue broadens, it becomes more difficult and I think does not serve a particularly useful purpose. But if you adopted it, I can assure that Oregon would be well participating and equally participating.

Senator HATFIELD. As I understand, you are really taking the Fifth at this moment. Is that right?

Mr. RUSCHE. No, sir. No, sir.

Senator FORD. Jim Beam is the best-seller. [Laughter.]

Mr. RUSCHE. Sir? Sir? He speaks about a person I don't know very well.

Senator FORD. Well, I want you to get acquainted with him. You said you were taking the fifth, and I said Jim Beam is the best-seller. [Laughter.]

Mr. RUSCHE. I'm sorry.

Senator FORD. That is perfectly all right. We have it in the record twice that way. [Laughter.]

Senator HATFIELD. Mr. Rusche, I am going to defer to my colleagues. I have some other questions that I would like to submit to you for the record.

Mr. RUSCHE. We would be pleased to respond.

Senator HATFIELD. And the Senator from Nevada, Mr. Hecht?

Senator HECHT. Thank you very much, Mr. Chairman.

Let's look at your statement, Mr. Rusche, on page 3, and let's just start there. I will use your own words. When you say, "many would have us renege on prior commitments and begin anew working toward yet another 'solution' the future of which no one can predict," that reminds me what Mark Twain once said. First you get the facts. Then you can distort them any way you want.

The facts relate to what is happening in other countries that we can absolutely predict. And the facts are that programs similar to legislation I have introduced are actually working, and the fact is that putting waste down 1,000 or 2,000 feet in the ground after perhaps five years, which you could do today under the present legislation, is something no one can predict.

What happens when you put this radioactivity down in the ground? This is what no one can predict. But by recycling it, by cooling it off, yes, we can absolutely predict that. I can put you on a plane and send you over to France, and you will see the complete nuclear fuel cycle. They do it very, very efficiently and with the MRS which we have also put down.

There are two types of waste: military and civilian. I still fail to see why we differentiate between them. Now, this is strictly a political decision. But in my opinion, there is far too much politics in nuclear waste and not enough credence to safety. And there is something that I absolutely think we have to look into, and that is the subject of reprocessing.

I want to go over your commentary on some of my bills which we talk about. You raise the question of many national policy issues raised by reprocessing. I think we have to address the situation of reprocessing. I think you stand alone because scientists all around the world, who I have been in contact with, feel that is absolutely the way to go. European countries do it.

I have been in contact with Dr. Teller three times on the phone the past week. I have asked him to come here. He has been unable to, but he is sending a representative to testify before us at a later time today, Dr. Miro Todorovich. And so, I am not going to debate you on scientific terms. Dr. Teller said that this man is far more knowledgeable than he is on nuclear waste and he represents 1,500 scientists and engineers around the world. So, I am going to let him come forward.

And you said on page 5, "We continue to believe that that was a correct choice" about the different types of wastes—separating them.

Let's go on.

Mr. RUSCHE. Excuse me, Senator. Could I interrupt just to ask you to help me understand what you are talking about by separating defense and civilian waste?

Senator HECHT. Of course. In the nuclear repository, you will put civilian and military nuclear waste. Is that not correct?

Mr. RUSCHE. Correct.

Senator HECHT. The military waste will be reprocessed; the civilian waste will not be reprocessed.

Mr. RUSCHE. Correct, as things now stand.

Senator HECHT. Again, I will not debate this with you because I will have scientists here debate this with you. But they cannot understand the rationale of not reprocessing civilian waste. And as the engineers in France and the scientists say, they get perhaps 97 percent of the waste out.

Why would you handle one type—it is the same nuclear waste. There is no difference. Is that correct—civilian and military?

Mr. RUSCHE. In general, that is correct.

Senator HECHT. It is so much more expensive to dispose of 97 percent than to dispose of 3 percent. And why would you go to all of the cost of disposing of all this volume? In other words, scientists around the world do not understand the rationale of handling waste two different ways.

Mr. RUSCHE. May I participate just a moment in the little dialog?

Senator HECHT. Of course, of course.

Mr. RUSCHE. I am not sure where the 97 and 3 percent come from, but I will set that aside for a moment.

Senator HECHT. Reprocessing removes roughly 97 percent of the volume.

Mr. RUSCHE. That is a set of figures that I have no familiarity with.

Senator HECHT. Maybe it is 96; maybe it is 98.

Mr. RUSCHE. It turns out that all of the heat-producing wastes are present in reprocessed waste just like they are present in spent fuel. The things that are removed are the long-lived isotopes which affect very long-term considerations, but do not affect the design of the repository at all because they are grossly overshadowed by the shorter term species which provide heat in the first 100,000 to 500,000 years. But perhaps we can set that aside a moment.

Let me try to be more conceptual if I can. In the first place the NWPA directs us to design a repository to be able to receive either kind of waste, reprocessed waste or spent fuel. And as I tried to say in my statement, the President concluded—and of course, I endorsed that because I was even a party to it several years ago—that the question of whether reprocessing ought to be done is an economic question. It does not affect the safety of what we are doing. It is an economic question.

And I think if you will speak to representatives of the industry, you will find—and in fact, I think the evidence is overwhelming because of what is in existence—that today the price of uranium and the uncertainties of many types having to do with reprocessing, not technical uncertainties—we have reprocessed in this country for now 40 years almost and are continuing to reprocess. It is not a technical question. It is an economic question. And we take the view that it is not the government's role to make that choice. The industry, the marketplace has made the choice in America that it is not right.

I mean, you go to France. I heard just recently the director of the French waste program when asked why are you doing what you are doing with nuclear power and with waste, and he said we had no other choice. We had no oil. We had no gas. We had no coal. And we had no choice. In America we have got oil and gas and coal and uranium. So, it is clearly an economic question that confronts the Congress and the country as to whether reprocessing be done.

I for one think it is the greatest thing that ever happened. It ought to be done. It would be very nice for it to be done, but it costs too much in America.

Senator HECHT. Now, I will answer you. I do not come from a farm state. From what I understand after voting for over four years, four and a half years, it is not economically feasible to go out and grow wheat. But we do subsidize wheat. We do subsidize farm products. So, now we are talking about subsidizing something right now in the best interests of the safety of people.

Now, oil and gas you mentioned. We have that in America, but we are talking about today. Let's take a long-range approach. Can you tell me that 25 years from now we are going to have oil in America? Scientists and geologists have appeared before our Energy Committee and said we are running out of oil right now. So, we are talking about waste for a period of 10,000 years in the ground. We cannot say what is economically feasible today. We have to look well, well beyond. And I say in 20 years—Secretary Hodel testified before us two or three times that he would not be surprised to see gas lines by 1990. Our oil supplies are going down. So, we cannot plan just for today.

Another question is, which scientists bring up to me, which will be brought up at a later time, why would we want to go to the tremendous expense of shafts and put waste down that has energy when, at a later time we may want to bring it back up again?

Mr. Rusche. The two points that I believe suggested that course to the Congress were: one, it is the best way we know to isolate the material from the biosphere and deal with the safety concerns that many people have; and secondly, it provides a suitable means for placing that material in such circumstances and providing for an opportunity for its recovery at some future time, today's circumstances being such that it is not now judged to be suitable for such recovery. Those two reasons I believe dictated the course.

Senator Hecht. I will have some rebukes on that not from myself, but from people far more knowledgeable. As I told you before, I am a businessman. Business people always go to the best brains.

Let me move over here to page 7 to the provision in my bill to have spent fuel stored for 50 years. I picked up the 50 years. Perhaps it is 42, perhaps it is 58, perhaps it is 65. You say, "We can find no particular technical merit in the proposition." Well, other countries do, and they would not think of putting nuclear waste in the ground until it has been stored for 40 or 45 years.

Again, I will go back to France. They would not consider this. The scientists we spoke to in France said absolutely not. How would you address that? You say this, but other countries—they do it differently.

Mr. Rusche. I would say that the benefits of delaying emplacement of such waste derive from the decay of the fission products and the reduction of the heat load that might be realized.

As to the affect on the design of the repository, it is not a philosophical question I am trying to deal with. I am trying to deal with it pragmatically and from a technical standpoint. It doesn't really make that much difference in the United States.

I have provided for you I believe on other occasions—we would be glad to provide again—a display that shows that in the United States until—let's see. I guess based on my information for about the first 18 years after the repository were to begin to operate, if it were to operate on the schedule we have proposed in the revised mission plan amendment, the fuel would be greater than 20 years old. The additional decay that occurs beyond 20 years to 40 years or however long is very marginal in terms of its effect on the design of the repository.

Senator Hecht. We will take issue with you at a later time this morning. But those are not the facts. The first 40 years is dramatic.

Mr. Rusche. I have got the curves, Senator. And I will be glad for you to look at them.

Senator Hecht. I have other curves, too, from scientists who would not ever consider that.

Mr. Rusche. The question is not 0 to 40, but the question is 20 to 40.

Senator Hecht. I do not agree with you, but why would you even consider, which is in the bill right now—is it not true after five years you could put the waste in the ground?

Mr. Rusche. We are obligated under the Energy Reorganization Act to be prepared to receive fuel as young as five years old. The design basis for the repository is 10 years or greater. The average age, the age up until about the first 20 years of emplacement, is greater than 20 years.

As you recall on other discussions we have had, I have pointed out that you do not go build the repository in a day or a month or a year and then go fill it up for the next 20 years. You essentially construct the repository as it is needed, and you take advantage of those factors, the factors related to the age of the fuel, so that you can design the repository most cost effectively meeting the safety requirements, as you described is your objective.

Senator **Hecht**. Wouldn't you say it is safer to transport nuclear waste after 40 years or 45 years than it is after just 5 years?

Mr. **Rusche**. Senator, that is just not a simple statement you can say yes or no to. If you take a cask that contains——

Senator **Hecht**. Well, I will have someone here at a later time scientifically which will absolutely say yes or no to that.

Mr. **Rusche**. Well, and I will be glad to debate with the person because it is not true.

Senator **Hecht**. I would be happy to have you stick around.

Mr. **Rusche**. I'll be glad.

Senator **Hecht**. All right. The last point here is my seabed disposal.

Mr. **Rusche**. Yes, sir.

Senator **Hecht**. My seabed bill would promote a 12-year-old international cooperative research effort that was abruptly terminated this year. You terminated your efforts on that. Is that correct?

Mr. **Rusche**. Correct, so testified.

Senator **Hecht**. As of yesterday in a long discussion with Dr. Teller, it is his feeling—I do not want to put words in his mouth because his representative will be here at a later time—that that has possibilities, and it should be looked into.

My question in my mind right now is why would we want to spend billions of dollars to go ahead on geologic disposal if at a later time we might want to change the course.

Now, the Pentagon who gets badgered by Congress every day, all the members—when they see they have a new tank or a new weapon system that is not correct, which they thought 10 years ago would be correct, they abandon it. They do not throw good money after bad.

If we have alternate disposal options like seabed disposal, which European countries are working on very, very much—we saw alternatives in Sweden and with the nuclear power plants in the east—that would save a lot of transportation out to the west. And why would we not want to proceed with this type of research before we spend billions of dollars drilling shafts?

Mr. **Rusche**. I believe that we have learned nothing that would suggest that we are spending good money for bad; that is, the geologic disposal is not the right choice. And I believe contrary to what you may have gained as an impression, every country that I know of in the world has chosen geologic disposal as its permanent disposal method.

Senator **Hecht**. All right. Name one country that has done it.

Mr. **Rusche**. That has done it?

Senator **Hecht**. Yes.

Mr. **Rusche**. The Swedes have chosen, the French have chosen, the British have chosen.

Senator HECHT. Where have they put—tell me one country that has already put their nuclear waste into the ground?

Mr. RUSCHE. Surely you do not mean just in the ground. You mean something more than that.

Senator HECHT. The final repository. Name me one country.

Mr. RUSCHE. No country has a final repository in operation at the moment.

Senator HECHT. Thank you. Because they want to get the best possible way, and they are working on trying to get rid of the rest of this high-level radioactive plutonium, so on and so forth. And if possible they want to reuse it and not put energy into the ground.

Mr. RUSCHE. Those are all elements in their thinking. I believe though my statement is correct that the United Kingdom, Sweden, France, Germany and Japan have all chosen as a matter of public policy deep geologic disposal for their waste. And I believe that is a correct statement. If I am wrong, I stand to be corrected. But I am in close contact with each of my colleagues in those countries, and I believe that is the case.

Senator HECHT. Well, scientists we spoke to in France look on that as an alternative down the line, but in the meantime they are using MRS facilities, which is the last question—I'm sorry. Senator Evans—he might want to go into that. But I deeply feel that his bill which I co-sponsor has a lot of merit to have four sites geographically located around America.

I have taken a lot of time, Mr. Chairman. I know Senator Evans is going to go into his bill. But I think it has a lot of merit. And if your schedule would permit you, I would be happy to have you stick around today because it should be very interesting.

Mr. RUSCHE. I might be able to stick around this morning, but I would be glad to meet with the people that you suggest might be prepared to debate the issue.

Senator HECHT. Thank you.

Senator HATFIELD. The Senator from Kentucky?

Senator FORD. Mr. Chairman, I just have one or two questions.

Ben, how will reprocessing affect the design and safety of a repository?

Mr. RUSCHE. Reprocessing does not have a very major effect on the design of the repository, as much of our discussion has just gone to. The primary feature that affects the design is the heat that you emplace.

Senator FORD. What percentage would it affect in cost?

Mr. RUSCHE. I can imagine extremes. It might affect the amount of required space for a given amount of waste by 15, 20 or 30 percent.

Senator FORD. There is currently an onsite representative from the—is it Nez Perce Indian tribe at the Hanford Reservation? I am not sure that tribe—it only had three letters to it, but usually four is my limit.

Are there plans for having onsite representatives from other Indian tribes or the state?

Mr. RUSCHE. We are prepared to work with them. And if that seems to suit the purpose, we would be glad to have them.

Senator FORD. Do onsite representatives have full access to DOE officials and contract personnel?

Mr. RUSCHE. I believe so.

Senator FORD. Are there state representatives onsite at the Yucca Mountain?

Mr. RUSCHE. At Yucca Mountain? That is a rather amorphous term at the moment, and we do not have very much work going on on the site. There is certainly local representatives of the state that are actively involved.

Senator FORD. You would be wiling to have them though, wouldn't you?

Mr. RUSCHE. Indeed.

Senator FORD. OK.

Mr. RUSCHE. Invite them.

Senator FORD. And they would have the same access or complete access.

Mr. RUSCHE. Indeed.

Senator FORD. Let's talk about the seabed repository. You say you have withdrawn from study of it. What kind of location were they looking for or where was the promising site?

Mr. RUSCHE. The two sites that have been under investigation were a site off Hawaii and a site in the North Atlantic whose precise location I cannot describe. But these were experimental sites. A site that was eventually chosen, should it be decided that it was feasible and appropriate, would undoubtedly derive benefit from those studies, but would primarily I think be determined in light of the location of a port of embarkation or a port of shipment for such material.

I notice that Senator Hecht does not have a shipping port, that is a port from which we would ship material from Nevada. Excuse me. I was being funny. [Laughter.]

Senator HECHT. No, but there is an earthquake fault going down California, and there are certain people selling ocean front property in Nevada right now. [Laughter.]

Mr. RUSCHE. In that case Nevada might qualify for a shipping point.

Senator FORD. Well, if Nebraska can have a navy, Nevada can have a shipping port, Ben.

Of course, when you get to that, that does create another problem. You have got to have a port from which to ship.

Mr. RUSCHE. It does.

Senator FORD. There is the problem of getting it there.

Mr. RUSCHE. It does.

Senator FORD. I think we are all nervous about this and some states are more nervous about it than others.

Mr. RUSCHE. Yes, sir.

Senator FORD. And I think we have to be very careful.

I have two or three other questions, Mr. Chairman, that I will send to the Director and ask for his comments in writing. I thank you for the opportunity.

Senator HATFIELD. Thank you, Senator Ford.

Senator HECHT. Mr. Chairman, may I just say one thing to Senator Ford?

Senator HATFIELD. The Senator from Nevada.

Senator HECHT. There is no reason to be nervous over this. The plan, the nuclear cycle—it can be worked out. It is being worked out in other countries. We have to go to an energy policy here in America. We are running out of oil.

Senator Ford. Well, let me tell you. We have been fighting since 1971 here for new technologies in coal research, and about the time we get started pretty good, somebody cuts out their throat. We try solar. We try all the other things. I do not see anybody standing up trying to help us get to new sources of energy of sources we already have.

Now, if you want to argue about reprocessing, that's a specific problem for your state and a problem which you are interested in now. We have been at a long-range, long-term solution to energy shortages for a long time. And we tried on the Senate floor, and you voted against it, that if the President has to trigger at 50 percent of imports. So, just because reprocessing is——

Senator Hecht. No, I voted for that, sir.

Senator Ford. You voted for the notification?

Senator Hecht. Yes, at 50 percent. I voted for that.

Senator Ford. Well, I will apologize to you and I will put that in neon lights.

But that is the problem we are facing here in this committee and in this——

Senator Hecht. The Bentsen provision?

Senator Ford. Sir?

Senator Hecht. Was that the Bentsen provision?

Senator Ford. Yes.

Senator Hecht. Yes, I voted for that.

Senator Ford. Wonderful. I am glad to know you were on our side.

Chic, I just took it for granted that you were staying with your side.

Senator Hecht. I think energy is above politics.

Senator Ford. Wonderful. [Laughter.]

Senator Hecht. Mr. Chairman, I want this as a matter of record, and we will see how far above politics this Senator is when we get to clean coal technologies and a few other things.

I thank the distinguished Senator for giving me an opportunity to get that off my chest. [Laughter.]

Senator Hatfield. I wonder if the Senator from Washington State would indulge me for just a moment. My schedule is such that I can only preside over an hour of this hearing.

Senator Evans. Certainly.

Senator Hatfield. If the Senator from Washington would be willing to take the gavel, but before I do that, would he give me the privilege of introducing the official witness from the Governor of Oregon for a one-page statement? And if Mr. Rusche would step aside for just a moment to be interrogated by the Senator from Washington State, I appreciate the courtesy.

I would like to invite to the table at this time Mr. Michael Grainey who is the Deputy Director of the Department of Energy in the State of Oregon representing Governor Goldschmidt. And Mr. Grainey, as you know, Governor Goldschmidt was here yesterday in the city and we had a good visit about this subject, and he indicated again his great regret that he could not remain overnight for an additional day to testify, but indicated you would be speaking on his behalf. So, if you would give the testimony on behalf of the State of Oregon at this point, I would appreciate it.

STATEMENT OF MICHAEL GRAINEY, DEPUTY DIRECTOR, OREGON DEPARTMENT OF ENERGY

Mr. GRAINEY. Thank you, Senator Hatfield, members of the committee. I am very pleased to be here and doubly so because I want to take the opportunity to commend you, Senator Hatfield, for the leadership particularly on energy conservation over the years. I implement the programs in Oregon and have seen the benefit of those energy conservation programs. It is through your leadership of the last 10 years that those programs have been funded, and we appreciate that very much.

Governor Goldschmidt's statement has been distributed, and with your approval I will just have that introduced in the record and just add a couple of remarks.

The Governor does very strongly support Senate Bill 1007. As you mentioned, the Columbia River is vital to the wellbeing of the State of Oregon to our multimillion dollar fisheries industry, our $2 billion a year agricultural industry. These could all be jeopardized with contamination of the river.

Perhaps equally seriously could be the contamination of the Oregon groundwater of northeastern Oregon which from what indications we have, contamination from Hanford could literally go under the Columbia River into Oregon into one of the most important farming sectors of the state.

The transportation risks of a Hanford repository would be very serious in Oregon, especially in the winter months along Interstate 84 in northeastern Oregon. It is a very difficult and hazardous journey in the winter.

And I think our concerns are justified based upon the performance to date of the N reactor, the other old reactors existing—defense waste that needs to be cleaned up. There is defense waste there that would literally fill RFK Stadium 100 yards high that present a danger to the health and safety to the people of the Northwest. These need to be addressed before any kind of questions about a repository can be answered.

Finally, I think your bill provides a good balance for giving the state the opportunity to participate. Oregon borders Nevada and Washington. And under your bill we would have affected state status only for the Hanford repository, not for the proposed site at Nevada. And I think that makes sense. Oregon's interests are much more vitally affected by the location at Hanford than they are at Nevada.

With that, Mr. Chairman, I would be happy to answer any questions.

[The prepared statement of Governor Goldschmidt follows:]

NEIL GOLDSCHMIDT
Governor

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM, OREGON 97310-1347

TESTIMONY
OF GOVERNOR NEIL GOLDSCHMIDT

BEFORE THE UNITED STATES CONGRESS
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

Chairman Johnston, Senator Hatfield, and members of the Committee:

Thank you for giving me the opportunity to speak with you today. The issue before us is one that in a matter of grave concern to Oregonians, to me, and to our senior senator, Mark Hatfield, who introduced Senate Bill 1007.

The State of Oregon strongly supports Senate Bill 1007. This measure would provide "affected state status" to states that border on major rivers or are situated above aquifers near which a nuclear waste repository would be built. The bill recognizes that those adjacent states would be as vitally affected as a host state by a nuclear waste repository. At the same time, we believe that this bill will not unduly inhibit the workings of the Nuclear Waste Policy Act.

Oregon is unique among the states that are adjacent to a potential host state.

The Columbia River is Oregon's lifeblood. The river has been contaminated in the past by discharges from eight old nuclear reactors at Hanford. Today, Hanford groundwater is threatened by contamination from open trenches and leaking tanks of radioactive wastes.

The Columbia collects groundwater from the nuclear reservation. The river then flows westward for 300 miles past and through communities that comprise more than half of Oregon's population.

Leaks from a repository at Hanford could reach local groundwater and the Columbia. Oregon simply will not accept the threat that Hanford will again poison the Columbia River with radioactive contamination.

In terms of potential risks to people, no other state -- not even Washington -- has the potential to incur more harm from water contamination.

The second reason Oregon must have equal legal standing is waste transport. There will be added risks imposed on us by the increased transport of high-level radioactive wastes -- whether or not Hanford is chosen.

Hanford is at the Southeastern corner of Washington State. Because it is so close to the Oregon border, wastes shipped to or from Hanford will travel farther on Oregon highways than on Washington's.

There is 40 years accumulation of radioactive wastes at Hanford. Oregon has decided that the wastes must be cleaned up to protect groundwater and the Columbia River. When the wastes are removed from Hanford, Oregon faces the added risks of having 7,000 truckloads of radioactive waste on our highways.

Again, the risks to our people and our environment exceed those for Washington. We must have legal standing equal with Washington if we are to be certain our concerns are addressed properly.

Senator Hatfield's bill simply recognizes the impacts that a repository would have. At the same time, it provides a reasonable approach for giving states near a repository a role in siting the repository, but only if those states have a legitimate interest. For example, Oregon borders on both Washington and Nevada. Under this bill, Oregon would have affected status for the Hanford repository, but not for the repository in Nevada. We believe that approach makes sense. Oregon's interests are focused much more on a repository on the Columbia River than by a repository at the far end of Nevada.

I urge the committee to give its full support to this legislation.

Senator **Hatfield**. Thank you very much.

Mr. Grainey, could you give a brief résumé of any estimate on the amount of money or costs to the State of Oregon that they have had to expend since the proposed at Hanford has been announced and some of the activities, including some of the citizen concerns in our state?

Mr. **Grainey**. Yes, Senator. With your help, the Federal Department of Energy this past year has begun already in Oregon $500,000 a year to do a technical evaluation of the work at Hanford. But the state's work has gone on before then. We have had a working group of some 10 agencies, the state's Department of Geology, Water Resources, Environmental Quality, examining work at the Hanford site and work related to these such as contamination by the defense waste, problems with the N reactor.

In addition, the attorney general's office has felt it necessary to file lawsuits on the matter of the waste repository. The attorney general's lawsuit itself is costing us probably $1 million a year.

With respect to the other work we have done, it would be difficult to quantify it entirely. But I certainly think it would be on the order of between $500,000 or $1 million a year, or more than the Federal grant that we are getting.

Senator **Hatfield**. Thank you very much. Express to the governor again my appreciation for his sending you to testify here before our committee this morning.

Mr. **Grainey**. Thank you, Senator.

Senator **Hatfield**. If you will stand by for questioning later from Senator Evans or any other members of the panel, I would appreciate it. And I would invite Mr. Rusche to come back to the table at this time.

I appreciate the fact that my colleague and neighbor and friend from the State of Washington who is long-time interested in this subject and a leader in trying to bring about a resolution of the problem is willing to take the Chair.

Senator **Evans**. I thank the Chairman.

As the Chairman leaves and as Mr. Rusche takes the stand again, I have a question to ask him that might be of great interest to my colleague from Oregon.

Mr. Rusche, I have got in front of me—and we have gone over this ground, and plowed it so many times that by now it has got to be fertile—the multi-attribute utility analysis which you mentioned. And every time I go over this, I get more distressed than the previous time I went over it. Let me refer to the sensitivity of—and there are several charts in there which relate to the first one—the Sensitivity of the Expected Post-closure Utility and the Equivalent Releases Scaling the Probabilities of Disruptive Scenarios.

In English does that mean the relative chance that there would be some kind of a catastrophe in each of the sites?

Mr. **Rusche**. I think so given the circumstances they describe there.

Senator **Evans**. All right. That chart shows Hanford fifth out of five.

The next chart is Sensitivity to Variations in the Values of the Scaling Factors, Hanford fifth out of five.

Sensitivity of Expected Post-closure Utility to Uncertainty and Correspondence Between Site Characteristics and Releases for the 10,000 Years. In other words, the relative potential of the various sites for releases to the surrounding biosphere or material in which they are encapsulated. Hanford not only number 5, but extraordinarily number 5.

Then the composite analysis where all of the factors are taken into account, Composite Utility of Sites for All Possible Pre-closure/Post-closure Weighting and Base Case Assumption. That is wrapping everything all together. Is that correct? Hanford fifth out of five.

Site Composite for High Post-closure Weightings Calculated under Base Case Assumptions, Hanford fifth out of five.

Site Composite Utilities Calculated under Optimistic Assumptions for Post-closure and Pre-closure, Hanford fifth out of five.

Site Composite Utilities Calculated under Pessimistic Assumptions for Post-closure and Pre-closure, Hanford fifth out of five.

Site Composite Utilities Calculated under Pessimistic Assumptions for Post-closure and Optimistic Assumptions for Pre-closure, Hanford fifth out of five.

Site Composite Utilities Calculated under Optimistic Assumptions for Post-closure and Pessimistic Assumption for Pre-closure, Hanford fifth out of five.

Senator **Hatfield**. Would the Senator like to yield? Maybe the gentleman would like to revise his response to my question about three coins and odd man out.

Mr. **Rusche**. Not at all.

Senator **Evans**. Doesn't that—at least those are all the charts you put in there. So, I presume that they capture all of the various ways in which you can match these sites one against another. Isn't that correct?

Mr. **Rusche**. They do represent a collection of such ways, but I believe even in the tables, not having the document before me—I am speaking from memory. But I believe those very tables that represent the composite show several different ways to aggregate the composites, and at least two of those ways show Hanford number 1.

Senator **Evans**. Well, and those two ways are when you ignore cost. Is that correct?

Mr. **Rusche**. That is exactly correct.

Senator **Evans**. Well, it's correct, but it isn't right.

Mr. **Rusche**. Well, that's a difference of opinion. That's a difference of opinion.

Senator **Evans**. I do not know how you can ignore cost in any kind of a consideration like this. I am afraid that that is where the Federal Government has gotten in the biggest troubles it has been in in the last century by ignoring cost.

Mr. **Rusche**. Senator, you and others have repeatedly spoken to me, Senator Hecht has spoken to me this morning about the importance of safety. Cost estimates of a repository for which we do not have a design today are highly speculative. The data that we have on physical characteristics we believe to be more reliable and a better basis for making the judgment. And that is what we used.

I regret that we do not agree, but I have not yet found that criterion that says one is right and the other one is wrong.

Senator EVANS. Mr. Rusche, let me begin with my own questioning.

To what degree were you involved in the development of the Nuclear Waste Policy Act of 1982?

Mr. RUSCHE. In its final development, absolutely none. I served as assistant to Secretary Edwards from 1980, when he was appointed, until July of 1981. There was a good bit of effort during that period on the two courses that were under review in the House and the Senate. I left that service in July and between July and December of 1982, the bill was brought to conclusion. In fact, its present form was one that I did not see at all.

I have had a chance to go back and read some of the congressional activity that went on to the extent there is a record. So, my comments today were based as much on that as well as commentary from others, but not of firsthand experience.

Senator EVANS. So, your statement on page 1 of your remarks that "We believe that permanent geologic isolation, deep underground, in solid rock formations coupled with integral Monitored Retrievable Storage is an excellent choice," that is just taking the Act as it was presented to you and for your management—you think it's swell because this is what you were given to work with.

Mr. RUSCHE. Well, not quite. If you recall when I was confirmed, I believe you were present at that confirmation hearing. The way the Act is literally written with respect to MRS, the Act sort of suggests that MRS ought to be an alternative, that is a fall-back or a backup position. In my confirmation testimony, based on the study I had done prior to that period, but after appointment, I concluded that the integral system was the better choice. And I made that comment rather extensively in my confirmation statement.

So, the course that we have been on has been based on that premise which we spent a good bit of time looking at which was the better course, and we concluded that is the better course.

Senator EVANS. But from your testimony I believe you also said that it was the Department's view or wish, if I can find it here, that the MRS would not be——

Mr. RUSCHE. A substitute for.

Senator EVANS. It would not be sited or would not be approved until such time as a deep repository had been approved for construction.

Mr. RUSCHE. That is the proposed linkage that we have in our current MRS proposal that we have submitted to the Congress.

Senator EVANS. And you said, "Congress determined that the legislation should be carefully crafted to insure that an MRS facility not become the defacto permanent repository. The Department, still sensing this potential, included in the MRS proposal a provision that Congress tie the opening of the MRS to receipt from the Nuclear Regulatory Commission of a construction permit to begin constructing the permanent facility."

Mr. RUSCHE. Yes, sir.

Senator EVANS. Therein may lie some of the biggest problems we have.

You mentioned that all of these other nations have embarked on deep geologic storage.

Mr. RUSCHE. I said they had selected it as a policy choice.

Senator EVANS. As a policy choice.

Mr. RUSCHE. Yes, sir.

Senator EVANS. None of them have constructed one yet.

Mr. RUSCHE. No, but at least two have such facilities under construction or in the final stages of determination, those two being Sweden and Germany.

Senator EVANS. Those countries already have MRS facilities in existence and operating?

Mr. RUSCHE. In the case of Sweden, for sure. They have the CLAB facility in operation.

In the case of Germany, they do not in that they are having their fuel reprocessed externally. They are considering reprocessing operations, but that choice has not yet been finalized internally. So, they do not have an MRS in operation in Germany.

Senator EVANS. And France has an MRS in operation.

Mr. RUSCHE. Or a temporary storage facility of some sort.

Senator EVANS. Well, how would you distinguish between a temporary storage facility and an MRS?

Mr. RUSCHE. They certainly have some of the same characteristics. An MRS is a much more operational facility than just storage, at least in our concept. It is not just a place to send the fuel. It is a place to manage it, to package it, and prepare it for final disposal.

In the case of the French, I believe that since they do not know where the fuel or the waste will eventually be disposed of, they do not conduct those kind of operations. And that is a difference.

Senator EVANS. Well, wouldn't you say that vitrification of fuel goes a long way toward putting it in its final packaging?

Mr. RUSCHE. It certainly does put it in another package, but the fuel assembly itself represents a kind of package. I think in the end what one has to do from a technical standpoint is prepare a package which is of suitable material to match the kind of geologic and geochemical environment in which you finally place it. For example, a package to be placed in salt would be quite different from a package to be placed in tuff or in crystalline rock.

Senator EVANS. Without getting into some of the wording listed in your statement which I find in some cases—well, perhaps not necessarily offensive, but I think that the wording is tilted in a way which I do not think is justified in the relationships with others where you say that now "many would have us renege on prior commitments and begin working toward yet another 'solution' the future of which no one can predict." I would certainly hope that you do not suggest that Representative Udall, for instance, would have us renege on prior commitments.

Mr. RUSCHE. No. In fact, he has told me just the contrary personally.

Senator EVANS. He is talking about beginning anew working toward yet another solution.

Mr. RUSCHE. I do not believe he has in mind working towards another physical solution. I think he has in mind working toward another institutional or political solution implying, as he has spoken to me, that those are certainly factors that we have not mastered yet.

Senator EVANS. You go on to say, "Unfortunately, there are also those who do not wish us success or who would permit progress only on their terms." Can you go on to identify any of those?

Mr. RUSCHE. I think I would prefer to leave the statement in general terms, but there certainly are people who come to tell me that they do not care to see the program proceed because it will provide the opportunity for the nuclear option to lose one of its principal objections. And I think it does no one any value to call names in that regard. But there certainly are those.

Senator EVANS. Well, I would suggest that when you use fairly flamboyant terms of that kind and put them in general terms, then you tar everyone with the same brush or at least you broadly use the brush without being specific. And I think that that may well be unfair to many of those who have a real concern about doing things, doing them right, and in fact, getting us back on the track which we have veered from rather substantially.

Mr. RUSCHE. Well, Senator, if I have been guilty of that, shall I say, mischaracterization, I certainly intended no offense to you or this Committee who have been strong interactors and supporters in trying to find a practical way to have this activity conducted.

Senator EVANS. No. I am not concerned about me, and I suspect none of the members of the committee are either. That is our task, to engage in debate back and forth. But it's those on the outside who have no such opportunity to either defend themselves or to——

Mr. RUSCHE. I have not found anybody yet that doesn't have an opportunity to defend themselves the way we are having to conduct this program.

Senator EVANS. Let's turn to some of the more specific elements that we have in front of us. Senator Hatfield mentioned the potential of hydrological studies and the fact that these major bore holes could affect the studies themselves. And you in your response, as I wrote some notes down here, said site disqualification is what we are really aimed at, looking at those things that may disqualify a site so we do not have to go clear through the process and spend all of the billion dollars necessary for full site characterization.

That's a pretty fundamental and I think a worthwhile concept, but isn't that something of a change from the original way you started at this process? Isn't that a new discovery of the Department?

Mr. RUSCHE. I would not characterize it as being new, but I would suggest that we have amongst the multiple parties that have both insight and interest in the subject been able to reach a common conclusion as to some of the ways that we can do that better at Hanford than we had before. That was the large-scale hydraulic test that I had mentioned to you.

Senator EVANS. Tell me again. When did you reach that conclusion, and how long will it take to prepare for and embark upon that study?

Mr. RUSCHE. A large-scale test of some sort aimed at attempting to evaluate the communication between various strata or aquifers in the basaltic flows and above has been an issue that was identified I believe in the environmental assessment.

The question that has been unresolved was trying to find a set of procedures or tests that we and other people in the scientific community and the affected parties could agree would be something that would serve that purpose. We have worked with the U.S. Geological Survey. We worked with the surveys or the equivalents thereof in both Oregon and in Washington, with the Indians, with the NRC, and I believe it was in February that we finally came to a conclusion after having had another set of external consultants advising us in the light of all that data.

I in my opportunity to conduct an occasional review at the sites—I believe it was almost 18 months ago—reviewed a then proposed set of tests for this very purpose. And we all concluded that we did not yet have a valid basis for proceeding with the tests. So, it is not something that has occurred in the last week or month or two. It is something that has been under discussion for at least a year and a half or two years.

Senator EVANS. But during that period of time, you said earlier on you do not have a valid way of conducting the tests or had not arrived at that. But did you have a concern about having the information that would result from such a series of tests?

Mr. RUSCHE. Oh, yes, indeed.

Senator EVANS. And at that time did you have a concern that drilling a major shaft could possibly disrupt the results of such tests?

Mr. RUSCHE. There were views from the very beginning that that might be the case. There was also the view though that the best way to make the determination eventually would be to sink the shaft. And as we have continued the shaft design work, which has proceeded over the last couple years, we have moved from a current impression of a design for a shaft and an approach to sink the shaft while at the same time considering the large-scale hydraulic test potential. And these have varied first one and then the other as to which should be done first. And we now are in the position that we are convinced that the large-scale hydraulic test needs to be done since we found a way that we could get the information.

We know we can get some information from sinking the shaft. There is no question about that. The question that has been under discussion for all this time is whether there might be data that would be lost or no longer accessible as a result of sinking the shaft, and we have gotten to the place where we think that there might be some and that we have a way to get it.

Senator EVANS. Did you transmit any of these concerns or questions to the committee or anyone up here on the Hill during the course of that year, year and a half that you were debating whether the shaft should come first or not?

Mr. RUSCHE. I do not recall. And we have answered so many questions for you—I think thousands of questions. I would have to go back and look to see. I do not have—I cannot think of a specific reference. I can recall conversations very much of the sort that we are talking about now about which should be done first. I believe it was with this Committee.

Senator EVANS. Well, I wish you would go back and see if you can find any of those. I probably haven't read every question that has been sent back to us in written form, but I certainly have read most of them. I do not recollect any such information which is, frankly, somewhat disturbing because we certainly did get very positive, direct and definitive requests from the Department to have the full amount of money set aside in the appropriations bill to go ahead and sink the major shaft.

Mr. RUSCHE. That is correct.

Senator EVANS. And it was only the Congress that denied you that opportunity during Fiscal Year 1987.

But I doubt very much—at least I am not aware of any Member of Congress or anybody I have talked to on the staff here that suggested that you not go ahead because it would potentially interrupt the flow of information from a broad hydrological test. It was for other reasons.

Mr. RUSCHE. I will be glad to look and see what I can find, but I can tell you that we have had extensive discussion with the NRC. We have had many public meetings on the subject. It has certainly not been something that has occurred in a less than open and straightforward way.

An additional activity that has given rise to our understanding is the fact that we have been preparing a site characterization plan. I do not believe you have seen any of those chapters. They are and have been provided to representatives of the States and Tribes in their various evolutions. The document itself will not be available until some time later this year. But in the course of conducting those discussions, the issue has also been a factor in our consideration.

Senator EVANS. You did not accompany any requests for appropriations, however, with the caveat that maybe we shouldn't be doing this——

Mr. RUSCHE. No.

Senator EVANS [continuing]. Until we find out just what we need to know about hydrological testing?

Mr. RUSCHE. No, because I believe it is fair to say—in fact, not fair—it is the case that when we made those requests, it was our view that the better course to choose was to go ahead and sink the shaft.

Senator EVANS. But you were aware at that time of the controversy——

Mr. RUSCHE. Oh, yes, and we had made the choice.

Senator EVANS. All right. Now you have another choice, which is to go ahead with the hydrological testing first. Is that correct?

Mr. RUSCHE. Yes.

Senator EVANS. How long will it take to prepare for and conduct those tests?

Mr. RUSCHE. To some extent, I believe some of them may already be under way. Some use existing bore holes and piezometers that have been in existence for a while.

Senator EVANS. I'm aware of that.

Mr. RUSCHE. There were a couple of bore holes I believe we had to enlarge to include additional piezometers, and those are I believe either under way or about to be under way. The tests will provide some information perhaps in six months. And depending on the nature of the information, we might decide we need longer than that and would continue them perhaps even as the shaft work were to begin.

Senator **Evans**. Six months. When would that likely begin?

Mr. **Rusche**. Possibly as early as now. I just do not know the exact—in fact, there is a site review going on——

Senator **Evans**. I wonder if you could give us for the record a plan for that, just how long it will take before you get to this—

Mr. **Rusche**. Sure.

Senator **Evans** [continuing]. And how long it will take to conclude those tests and to get such results back as will tell you whether you have got what you need to have.

Mr. **Rusche**. I would be glad to. There is a very detailed plan in existence, and I will be glad to provide it for you.

[The information follows:]

The large-scale hydraulic stress (LHS) tests were proposed to BWIP by the Nuclear Regulatory Commission (NRC) in July of 1983 in the form of a Site Technical Position (STP 1.1). The position paper was a direct result of the NRC's review of BWIP's site characterization report (published in 1982). The attached presentation, BWIP proposed draft test plans, were presented to the NRC and U.S. Geological Survey (USGS) in subsequent meetings in 1984, 1985, and 1986. The plans identified efforts that addressed all data needs that were believed to relate to the issues resolution and design requirements. Reviews of these plans by the NRC, USGS, and DOE Headquarters resulted in the organization of a geohydrology task group (by the Office of Geologic Repositories) whose purpose was to develop a more comprehensive test plan. The resultant plan identified a series of LHS tests that would be conducted prior to the drilling of the Exploratory Shaft (ES). The duration outlined in the plan is nominally two years and consists of three phases:

1) the emplacement of four additional monitoring facilities;
2) a quiescent period for hydraulic baseline control; and
3) a series of four aquifer (LHS) tests in the Grande Ronde Basalts.

Results of these tests will be available shortly after the analysis of the data is completed.

This pre-ES test plan was presented to the NRC, USGS, affected States and Indian Tribes at a workshop in April 1987. Both the NRC and USGS agreed that the test plan was technically sound and that BWIP should go forward with the plan.

The schedule for the initiation and completion of the LHS test plan is as follows:

8/31/87 Begin drilling of monitoring wells;
7/18/88 Begin first of a series of LHS tests;
6/30/89 Complete final LHS test.

In regard to the budget, a specific request was not included because the scope of the program was unknown. However, it was recognized that a program would be required and the Department believed there were funds to cover the activity.

HISTORY OF DOE-USGS-NRC INTERACTIONS

• November, 1982	DOE issues BWIP's Site Characterization Report (SCR).
• March, 1983	NRC issues Draft Site Characterization Analysis.
• May, 1983	USGS issues review of BWIP's SCR.
• June, 1983	Meeting of USGS and DOE/BWIP on BWIP's SCR.
• August, 1983	USGS sends letter to R.L. Morgan (DOE) on BWIP's SCR.
• July, 1983	Meeting of NRC and DOE/BWIP on geohydrology testing. NRC presents a draft of STP 1.1.
• December, 1983	NRC issues its final STP 1.1.
• June, 1984	Meeting of NRC and DOE/BWIP on BWIP's geohydrology characterization plan.
• July, 1984	Meeting of USGS and DOE/BWIP - Hydraulics Advisory Team (1st Meeting).
• November, 1984	Meeting of USGS and DOE/BWIP - Hydraulics Advisory Team.
• December, 1984	Meeting of NRC and DOE/BWIP on BWIP's geohydrology characterization plan.
• May, 1985	Meeting of NRC and DOE/BWIP on BWIP's geohydrology characterization plan.
• December, 1985	Meeting of USGS and DOE/BWIP-Hydraulics Advisory Group.
• December, 1985	Meeting of NRC and DOE/BWIP on BWIP's geohydrology characterization plan.
• April, 1986	NRC issues letter to O.L. Olson (DOE) on BWIP's geohydrology characterization Plan.

JUSTIFICATION FOR TESTING PROGRAM

The construction and operation of an exploratory shaft facility (ESF) at the Hanford site will significantly alter the existing geohydrologic system. These changes could compromise the results of some key geohydrologic tests if performed after the start of ESF construction. Given this circumstance, it is necessary to define a pre-ES geohydrologic testing program which provides necessary data before the disruptive events caused by the ESF and provides reliable information for resolving licensing issues.

OBJECTIVES OF TESTING PROGRAM

- To collect data on geohydrologic conditions that will be changed by site characterization activities.
- To collect data having the potential for providing an early indication of the presence of a disqualifing condition.
- To collect data on geohydrologic conditions in order to identify the effects of the ESF on the geohydrologic system and on subsequent geohydrologic tests.
- To collect data on geohydrologic conditions that may affect the design of the ESF or the repository.

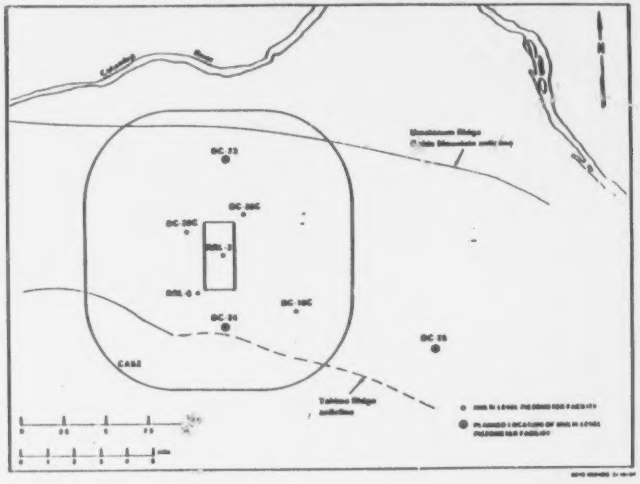
STEPS TAKEN TO PLAN A PRE-ES TESTING PROGRAM

- Organized a small working group of geosciences specialists consisting of two or three representatives each from DOE Headquarters, Roy F. Weston, DOE Richland Operations, and Rockwell International.
- Working group identified all issues from the Issues Hierarchy that require hydrologic testing to meet relevant information needs.
- Identified information needs for each geohydrology related issue and the parameters and tests needed to meet the information needs.
- Determined what tests must be run before and what ones can wait till after the First Exploratory Shaft is started.
- Developed a set of pre-Exploratory Shaft Geohydrology Testing Program options.
- Recommended an option for implementation.

— OPTION A —

Establish a hydraulic-head baseline only
Drill and equilibrate DC-24,-25

LOCATION OF MULTIPLE-LEVEL PIEZOMETER FACILITIES


Columbia
River
N
Umtanum Ridge
RRL-2
DC-24
DC-25
CASE
Yakima Ridge anticline

Pros

- Minimal schedule disruption on start of ES
- Least cost impact
- Yield data on perishable head conditions

Cons

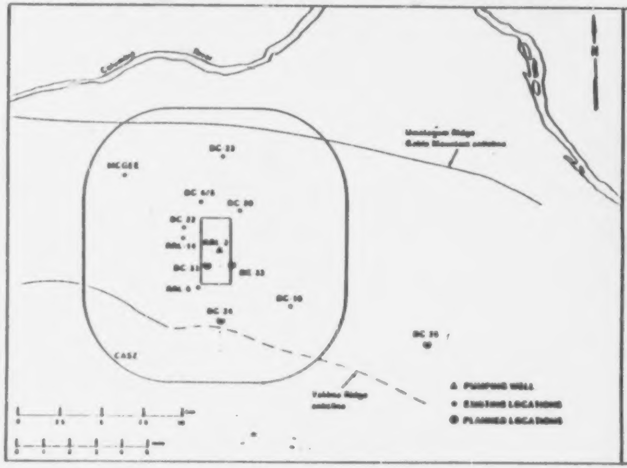
- Provide insufficient information about disqualifying conditions
- Provides no information to support engineering design
- Potential compromise of interpreting future test results
- Probably not credible with technical community
- Subject to severe programmatic criticism
- Gains no experience with testing procedures and equipment
- Potential change of hydraulic parameters in vicinity of ES not detectable

— OPTION B —

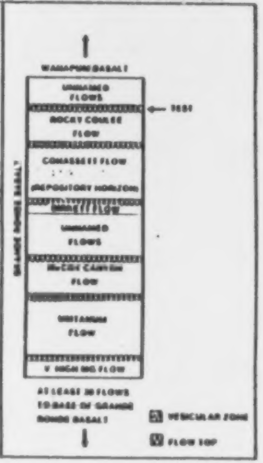
Establish hydraulic-head baseline and Test Rocky Coulee flow top only

- Drill and equilibrate DC-24,-25,-32,-33
- Pump RRL-2B
- Collect water samples (hydrochemistry)
- Conduct tracer tests

PRIMARY LHS TEST MONITORING FACILITIES IN THE ROCKY COULEE FLOW TOP


Columbia River
N
Umtanum Ridge
Gable Mountain anticline
MCGEE
DC 23
DC 6/8
DC 20
DC 22
RRL 14
RRL 2
DC 32
DC 33
RRL 6
DC 16
DC 24
DC 25
CASE
Yakima Ridge anticline
▲ PUMPING WELL
● EXISTING LOCATIONS
⊗ PLANNED LOCATIONS

STRATIGRAPHY OF THE GRANDE RONDE FORMATION


WANAPUM BASALT
UNNAMED FLOWS
TEST
ROCKY COULEE FLOW
COHASSETT FLOW
(REPOSITORY HORIZON)
UNNAMED FLOWS
McCOY CANYON FLOW
UMTANUM FLOW
V HIGH MG FLOW
AT LEAST 30 FLOWS TO BASE OF GRANDE RONDE BASALT
GRANDE RONDE BASALT
VESICULAR ZONE
FLOW TOP

Pros

- No reprogramming necessary; conform to current test plan and facilities
- Yields data on perishable conditions and hydraulic parameters of Rocky Coulee
- Provides some information on disqualifying conditions
- Expedites start of ES construction

Cons

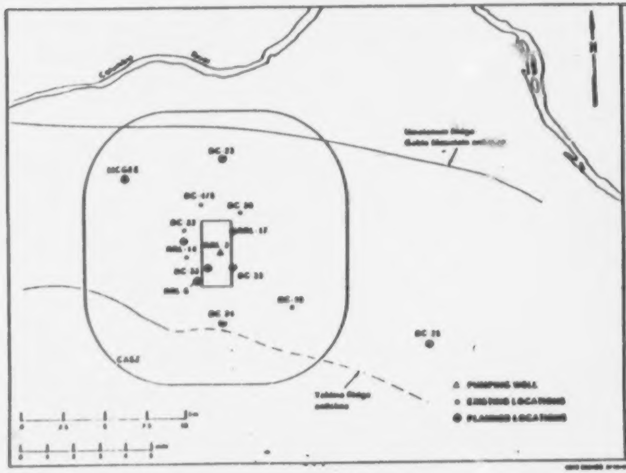
- Provides little information to support engineering design
- Provides little information on impact of ESF on future tests
- May not be credible with technical community
- Limited experience with testing procedures and equipment

— OPTION C —

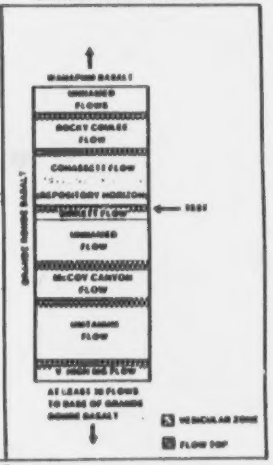
Establish hydraulic-head baseline and test Birkett flow top only

- Drill and equilibrate DC-24,-25,-32,-33
- Pump RRL-2B
- Collect water samples (hydrochemistry)
- Conduct tracer tests

PRIMARY LHS TEST MONITORING FACILITIES IN THE BIRKETT FLOW TOP


Columbia River
N
Umtanum Ridge
Gable Mountain anticline
DC-23
DC-6A/B
DC-4/5
DC-20
DC-22
RRL-17
RRL-14
RRL-2
DC-32
DC-33
RRL-6
DC-19
DC-24
DC-25
CASZ
Yakima Ridge anticline
△ PUMPING WELL
○ EXISTING LOCATIONS
● PLANNED LOCATIONS
0
2.5
5
7.5
10
km
mi

STRATIGRAPHY OF THE GRANDE RONDE FORMATION


WANAPUM BASALT
UNNAMED FLOWS
ROCKY COULEE FLOW
COHASSETT FLOW
REPOSITORY HORIZON
BIRKETT FLOW
TEST
UNNAMED FLOW
McCOY CANYON FLOW
UMTANUM FLOW
VERY HIGH MG FLOW
AT LEAST 30 FLOWS TO BASE OF GRANDE RONDE BASALT
GRANDE RONDE BASALT
VESICULAR ZONE
FLOW TOP

Pros

- Provides some information for engineering design
- Yields data on perishable hydraulic properties and conditions of Birkett flow top and Cohassett interior
- Provides some information on disqualifying conditions
- Provides some information on impacts of ESF on future tests

Cons

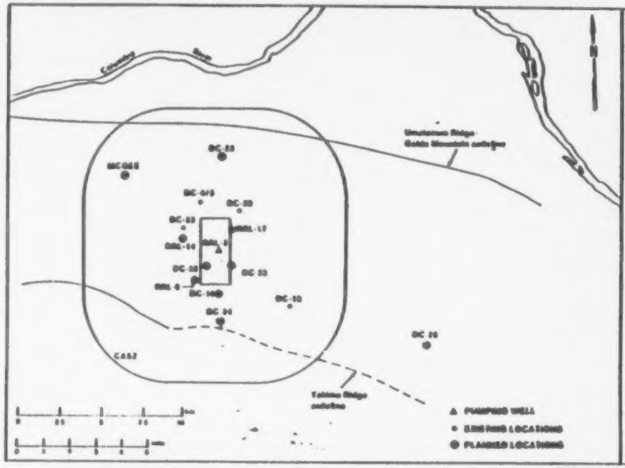
- Limited credibility with technical community
- Limited experience with testing procedures and equipment
- May delay ES construction schedule
- Requires modification to pumping well and additional monitoring facilities
- Some reprogramming required

— OPTION D —

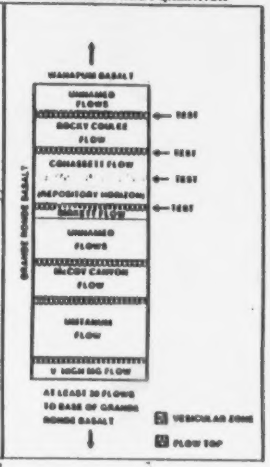
Establish hydraulic-head baseline and test multiple flow tops (Rocky Coulee, Cohassett, and Birkett and Cohassett vesicular zone

- **Drill and equilibrate DC-24,-25,-32,-33**
- **Pump RRL-2B**
- **Collect water samples (hydrochemistry)**
- **Conduct tracer tests**

PRIMARY LHS TEST MONITORING FACILITIES IN MULTIPLE FLOW TOPS


Columbia River
Umtanum Ridge-Gable Mountain anticline
DC-33
MC-065
DC-4/5
DC-20
DC-32
RRL-17
RRL-14
RRL-2
DC-25
DC-33
RRL-6
DC-16
DC-10
DC-24
DC-26
CASZ
Yakima Ridge anticline
0
2.5
5
7.5
10
km
0
1
2
3
4
5
mi
▲ PUMPING WELL
● EXISTING LOCATIONS
● PLANNED LOCATIONS
N

STRATIGRAPHY OF THE GRANDE RONDE FORMATION


WANAPUM BASALT
UNNAMED FLOWS
TEST
ROCKY COULEE FLOW
TEST
COHASSETT FLOW
TEST
(REPOSITORY HORIZON)
TEST
BIRKETT FLOW
UNNAMED FLOWS
McCOY CANYON FLOW
UMTANUM FLOW
V HIGH MG FLOW
AT LEAST 30 FLOWS TO BASE OF GRANDE RONDE BASALT
GRANDE RONDE BASALT
VESICULAR ZONE
FLOW TOP

Pros

- Yields data on perishable conditions in Grande Ronde
- Provides substantial information for engineering design at RRL-2 site
- Provides information on disqualifying conditions at RRL-2 site
- Enhances credibility with technical community
- Provides information to predict impacts of ES on future geohydrologic tests

Cons

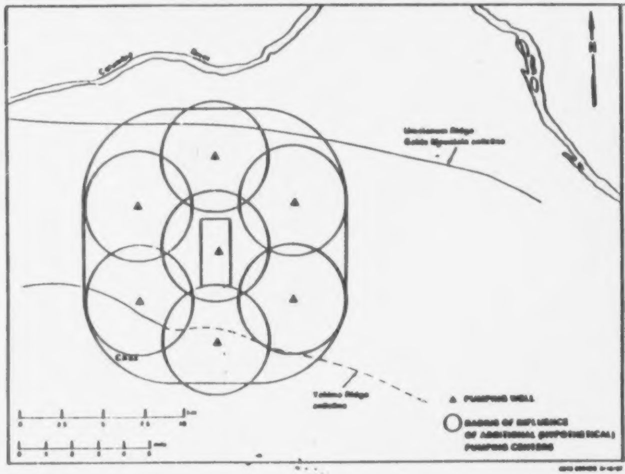
- Delays ES construction schedule
- Near-term site costs increase
- Requires additional monitoring facilities
- Reprogramming required

— OPTION E —

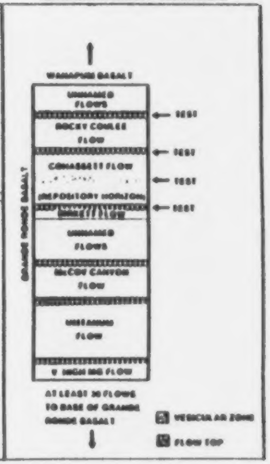
Establish hydraulic-head baseline and test multiple flow tops (Rocky Coulee, Cohassett, and Birkett) and Cohassett vesicular zone at several (3-4) additional pumping centers

- Drill and equilibrate DC-24, -25, -32, -33
- Deepen and pump RRL-2B
- Drill and pump other pumping centers
- Collect water samples (hydrochemistry)
- Conduct tracer tests

PRIMARY LHS TEST MONITORING FACILITIES IN MULTIPLE FLOW TOPS


Columbia River
N
Umtanum Ridge
Gable Mountain anticline
CASZ
Yakima Ridge anticline
PUMPING WELL
RADIUS OF INFLUENCE OF ADDITIONAL (HYPOTHETICAL) PUMPING CENTERS
0
2.5
5
7.5
10
km
0
1
2
3
4
5
miles

STRATIGRAPHY OF THE GRANDE RONDE FORMATION


WANAPUM BASALT
UNNAMED FLOWS
ROCKY COULEE FLOW
COHASSETT FLOW
(REPOSITORY HORIZON)
BIRKETT FLOW
UNNAMED FLOWS
McCOY CANYON FLOW
UMTANUM FLOW
HIGH MG FLOW
TEST
TEST
TEST
TEST
GRANDE RONDE BASALT
AT LEAST 30 FLOWS TO BASE OF GRANDE RONDE BASALT
VESICULAR ZONE
FLOW TOP

Pros

- Yields definitive data on perishable conditions in Grande Ronde
- Provides definitive design information over wide area of Cohassett flow
- Provides definitive information on disqualifying conditions over much of CASZ
- Provides some information on flow system boundaries
- Avoids interference from ESF activities and attendant interpretation problems
- High credibility with technical community

Cons

- Major delays in ES construction schedule
- Near-term site costs increase substantially
- Major reprogramming required
- Requires considerable monitoring and pumping facilities

RECOMMENDATION

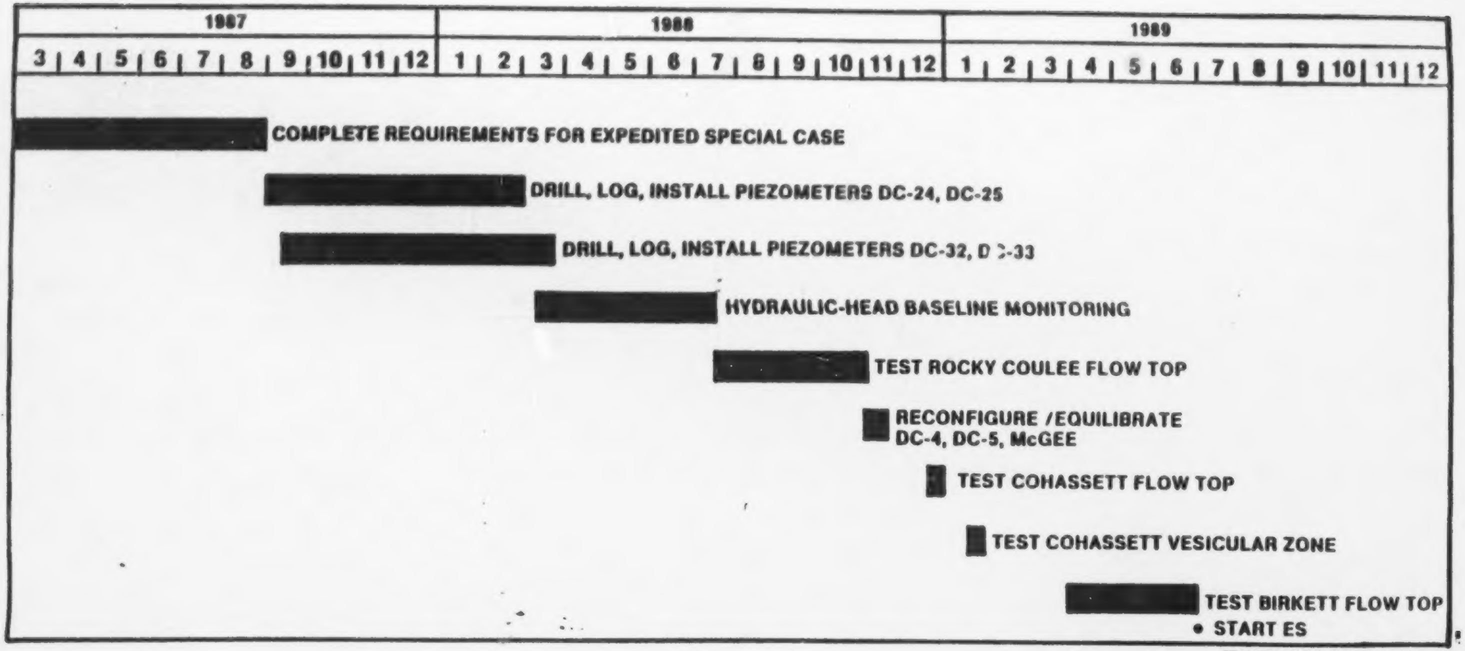
-OPTION D-

Top-down large-scale hydraulic stress (LHS) testing of the Rocky Coulee flow top, the Cohassett flow top, the Cohassett vesicular zone, and the Birkett flow top.

Preparation for testing and testing will include the following major activities:

- Rotary drilling of DC-24, -25, -32, -33
- Installation of piezometers at DC-24, -25, -32, -33
- Baseline monitoring of drilled wells
- Reconfiguration of existing boreholes (install piezometers) for boreholes RRL-2A, RRL-6, RRL-14, RRL-17, DC-4, DC-5, DC-16, and the McGee well.
- Successively pump (for LHS test) and deepen borehole RRL-2B

PRE-ES GEOHYDROLOGY TESTING
SCHEDULE OF MAJOR ACTIVITIES



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Senator Evans. That would be helpful because, as I remember from the testimony of some of the technical people here a couple of weeks ago, it seemed to me that it would take the better part of the next fiscal year to conclude those tests. And of course, if that is the case, there certainly is no reason for us to put in the appropriation bill the full funding for the necessary major bore holes that perhaps you couldn't conduct.

Mr. Rusche. Now, bore holes—do you mean the shaft?

Senator Evans. The shaft, major shaft.

Mr. Rusche. I believe that the schedule that we have in the Mission Plan amendment does not show shaft work beginning unless we were able to take this course with respect to the 600 foot down to the first basaltic flow, as suggested by Senator Hatfield. That is a course that we are looking at.

The thing that you have to balance, it appears to me from the standpoint of management efficiency as well as technical adequacy, is that the shaft is a large effort and a long-term effort. And it becomes the critical path. It is clear that we will not be able to qualify the site without at-depth excavations and tests. We may be able to disqualify the site from some of this earlier information, and that is what we are looking at. But I think that the first look may well tell us what we need to know.

We do have a plan, as I recall, that might have the tests continuing for 18 months, but whether that would be necessary to be done entirely before the shaft work begins is yet a matter for another discussion.

Senator Evans. Well, we will get the information and have a better idea then.

Mr. Rusche. Sure. I will be glad to speak to you privately and in more detail if you would like to.

Senator Evans. Let me turn to the—some of this may even sound familiar because I have been searching for it in the previous times we have had these conversations, and I cannot find it immediately.

But let's for the moment just wish away the Nuclear Waste Policy Act of 1982 and begin with what we would know now. If we were to redesign and to start all over again, knowing what we know, knowing the experience of other nations, knowing what has happened successfully and what has happened unsuccessfully, at this point what order of things would you think would be the most appropriate?

Would you say that moving ahead until you have final approval of a deep geologic storage before you give approval for an MRS is still the right way to go?

Or if we could start all over again, would it be more appropriate to move in a simultaneous fashion but to get the experience and the necessary collecting of material and the packaging of material, or the free packaging at least, in an MRS while at the same time searching as the French and the Swedes and others are doing for the deep geologic storage?

Mr. Rusche. Well, I believe our Mission Plan amendment gives one expression of that consideration. It does not wish away the act.

Senator Evans. The mission plan amendment really is——

Mr. Rusche. Is in the context of the act.

Senator EVANS. The parameters are the present act.

Mr. RUSCHE. They are indeed.

Senator EVANS. And what I am doing is relieving those parameters for you.

Mr. RUSCHE. I am having to express a personal opinion.

Senator EVANS. Well, your personal opinion is very important.

Mr. RUSCHE. I think that the act—and independent of the act's existence. I use the act only as a reference. I think the act represented a view by Congress that is very appropriate for this country or for any country who has nuclear waste that permanent disposal ought to be the end point of its waste disposal system.

Senator EVANS. I would not disagree with that at all. And I do not think either the Swedes or the French disagree with that either.

Mr. RUSCHE. I do not either. I believe that is a fairly universal conclusion.

If permanent disposal is to be the end point, then it appears to me that the people who are benefiting from the system and the existence of nuclear power ought to pay for it. And I think that the people who are benefiting from it ought to be a party to if not responsible for seeing that that is put under way.

So, to that end I think that we ought to have a definite program of permanent disposal under way. I think that with that premise or objective as the keystone of the program, that we ought to decide how best to manage the period between now and the time we get there.

I think, as I have said—again, if I may refer to my confirmation statement—that an interim storage facility called monitored retrievable storage or whatever you want to call it which has the capability of storing for a time and preparing and conducting certain other functions ought to be a part of the system. I think that there ought to be definite relationships between the two of these so that it is clear that the objective as best we can state it today and the commitment of the country today is to conduct our activities for eventual permanent disposal. So, the existence of a system, an integrated system, a term that I have used, the Department has used to describe this, I believe is the right course for the country.

Of course, I have not mentioned transportation and the associated auxiliary activities. But they have to be there for whatever we do. They are not unimportant. In fact, they may become very key factors. They would have to be a part of the system as well.

Senator EVANS. How would you rank the difficulty of successfully characterizing and putting under construction an MRS as opposed to a deep geologic storage?

Mr. RUSCHE. I think the MRS presents relatively few, if any, new technical challenges. It is a surface-based facility and has been done in one form or another in several places in the United States and perhaps in the rest of the world.

A geologic disposal site does not present very many more technical challenges, but they clearly are more difficult. I think the difficulty resides more in the ability to communicate the technical features and the confidence that attaches thereto rather than the technical features themselves. There are mines that have been done many places in the world that are far more difficult and far more challenging than the kinds of things that we propose.

Senator EVANS. Most of those mines are taking things out rather than putting things in.

Mr. RUSCHE. Yes, that is true.

Senator EVANS. But be that as it may, I am not sure how to put a number to it. But wouldn't you say that it's 10, 50, 100 times more difficult to achieve one successfully than the other?

Mr. RUSCHE. There is no doubt but that if you include all of the personal, institutional factors——

Senator EVANS. We have to. That is why we are here.

Mr. RUSCHE. There is no question that it is many times more difficult, but not technically.

Senator EVANS. Then with all of that, isn't the decision by the Department to hook an MRS and its successful implementation to the final approval of a deep geologic storage, in essence, just denying us the opportunity to move ahead on an MRS or MRSs that would be very useful and increasingly necessary interim places to store fuel unless we are going with the alternative, which is just leave them where they are?

Mr. RUSCHE. It certainly does have some potential for that.

Our conclusion to make the coupling though was derived from the very kinds of sensitivities that we have referred to in that the local communities that we have dealt with and many Members of Congress that have spoken to me both in hearings and personally retain the apprehension that with the existence of a temporary system such as MRS in existence that the country or the Congress or the administration or someone would lose confidence and courage to proceed toward that objective. And therefore, the provision—and I now have to put myself back in the context of the conclusion of the act or the objective of the act—to go to permanent disposal warrants some kind of assurance that this course is not a subtle or even intentional step in the direction of substituting temporary storage for permanent disposal.

Senator EVANS. Well, Mr. Rusche, if you have an act that says let's go to MRS now, let's use an added amount of time, but in the act we are setting some time frames and saying that at these times we shall have a deep geologic storage, you have no faith in that?

Mr. RUSCHE. Yes, I have faith in it.

Senator EVANS. OK. Well, in other words, with that kind of faith there is no reason to attach the two together, is there? If the basic law says let's move ahead with an MRS now, let's get it done, let's get it under construction, let's use it, and during that time and even some additional time let's do the process necessary to achieve a successful deep geologic storage, isn't that adequate?

Mr. RUSCHE. It certainly would be in many people's minds. In the end, as I have had the occasion to describe in many speeches and discussions, there is no greater confidence the country can have than that Congress has adopted the law. And that is the case with the NWPA. There are people who would have Congress adopt that feature in the law as added assurance. We thought that that was a good and practical course. If the Congress were to choose to do otherwise, we would certainly find that that is an acceptable course.

Senator EVANS. So, in other words, but you are not prepared. In other words, it sounds to me like you are having it both ways. You have great faith in the law you said, but you unilaterally as a Department are saying we are going to hook these things together and we are going to hold the MRS hostage to a deep geologic repository because we do not have faith in the law. Now, you cannot have it both ways.

Mr. RUSCHE. I do not believe the Department has acted at all, and certainly not unilaterally. What we have tried to do is exercise our judgment in the proposal which we rely on the Congress to make a judgment on. It was our judgment that having that content in the law would provide additional confidence.

Now, it is clear—and you certainly have been amongst the most sensitive I think and insightful ones in recognizing that the coupling that we have suggested may not be necessary, or there are other kinds of coupling, or there are other ways to provide confidence. But the law in the end, whatever its content, will be the basis that the public has I believe for its confidence in the future.

Senator EVANS. But you—and to the degree you can reflect the opinions of the Department—would have no difficulty in a law which said let's move ahead now without barriers on an MRS or a series of MRSs and at the same time move ahead albeit perhaps somewhat more slowly than the current process on a deep geologic storage, but with the assurance that there would be a time frame within which a deep geologic storage would be completed.

Mr. RUSCHE. Senator, we have had discussions with the local communities in Tennessee, and we have heard their plea and have indicated to them and committed to them that we would represent their view through the proposal as we have done it. Now as a practical matter, the kind of coupling that is needed to provide that confidence is represented in one case by our view. There may be others.

And I think the key objective is to provide that confidence. And we felt an obligation to honor the commitment that we had made, and we have, and recognize that there are other ways to do it.

Now, I am not trying to have it both ways. I am being very straightforward that the intensity of reaction to MRS in the House by many members of the House, as well as to the local community with regard to its becoming a substitute or a de facto repository, is just very high. And this course is one that has been almost universally suggested as the right course to add in the law additional confidence.

Senator EVANS. How would you rate the sensitivity and the concern of those who happen to live in states that are being considered as a deep geologic repository site? Just about as sensitive as those in the MRS states? Maybe higher?

Mr. RUSCHE. I think I understand your question. The answer is yes, if I understand it.

Senator EVANS. Sure.

Mr. RUSCHE. Yes.

Senator EVANS. In getting back to it, I simply cannot understand I guess the reluctance to hang onto that. Let's leave aside Tennessee for the moment. Let's leave aside the potential of an MRS at Hanford. Leave aside the location of the deep geologic storage at any state, and look at it as a problem. And if we have a problem ahead of us and if a law were written or the act modified to say simply and precisely we need to do something, certainly we do not need another moratorium for a couple of years and have another commission look at it. But some are suggesting that. That may well be the decision of this Congress if we cannot get better alternatives.

But to say, in contrast to that, let's move ahead with something that we know how to do that is substantially easier technically and every other way, something that has been done in other countries and we can see and feel and touch the operations and know something of what is going on, get that done, and at the same time move ahead on finding a deep geologic storage—with all of that in the law and a definition in terms of time frame to accomplish each of these, and leaving aside for the moment the understandable sensitivities, you do not really think that it is necessary to hook the two together and say that you cannot start one until you get the other one approved?

Mr. RUSCHE. No. Clearly the hooking together or the linking was for the purpose of providing confidence.

Senator EVANS. OK. Unfortunately, we have had trouble getting confidence, you know, any place along the line here. And I think that is what we have got to do now is to try to rebuild that confidence if we can.

Mr. RUSCHE. Well, I do not want to sound wrong, but I really appreciate the effort that you have exerted in trying to find a way to produce that confidence. I couldn't agree more.

And I tried to say in a very tactful way in the statement this morning that going back for another couple years or four or five or whatever and studying and spending another couple billion dollars is not going to tell us very much more.

Senator EVANS. I thoroughly agree with that. In fact, I kind of stood out in the whole delegation with one exception—opted for a halt in the process.

Mr. RUSCHE. Yes.

Senator EVANS. And I think we do know enough, but I think what we know best is how to take step one. Wouldn't you clearly say that if you are going to have an integrated system, step one is a monitored retrievable storage?

Mr. RUSCHE. It is certainly the first step and it is the step that can be completed first, ought to be completed first, and we ought to proceed with it. And I think we ought to proceed with the repository in parallel on a schedule. If the Act were different from what it is, the schedule might be different. We are constrained to the Act, and you know yourself—I am trying to remember. I do not think you have been one of those who have criticized us for being late as much as we have. We have introduced time and again additional time in the repository program where we thought it was necessary. And I get in another hearing, and I am criticized severely for not meeting the first deadline.

Senator EVANS. I understand. And I do not think you have been responsible for a lot of that delay. I think there have been other factors that have certainly been involved.

Mr. RUSCHE. Yes, sir.

Senator EVANS. Well, I appreciate it. I take that last statement as a ringing endorsement of the bill I just introduced. [Laughter.]

Mr. RUSCHE. As I said with Senator Hatfield, if your bill were viewed in the context of adaptability or adjustment, I think there is much to be said for it. I was constrained in my testimony even to look at the bill.

Senator EVANS. Of course. I know that.

Mr. RUSCHE. I do not think as it stands it is quite what we need, but I think in the vein of your conversation there is much to be had. I think there is other legislation that has potential. And putting these together in some way I think has great potential for making the program doable.

Senator EVANS. I have taken a long time. Let me just get finally to one element that I think we have kind of gone around and we did have some testimony on the same subject from the technical people whc were here.

Is my understanding correct that the design on which the least rough cost estimates have been based for the deep geologic storage is a design which assumes that the fuel to be inserted is 10 year old fuel?

Mr. RUSCHE. That is the design basis.

Senator EVANS. Do I remember correctly that also the design basis, the distance apart that you have to put the casks of material, and the amount of area and resulting excavation is a function of the heat load of the material?

Mr. RUSCHE. It is indeed.

Senator EVANS. Do I also remember correctly the figure, something like 57 kilowatts per acre, as being the right figure from the last——

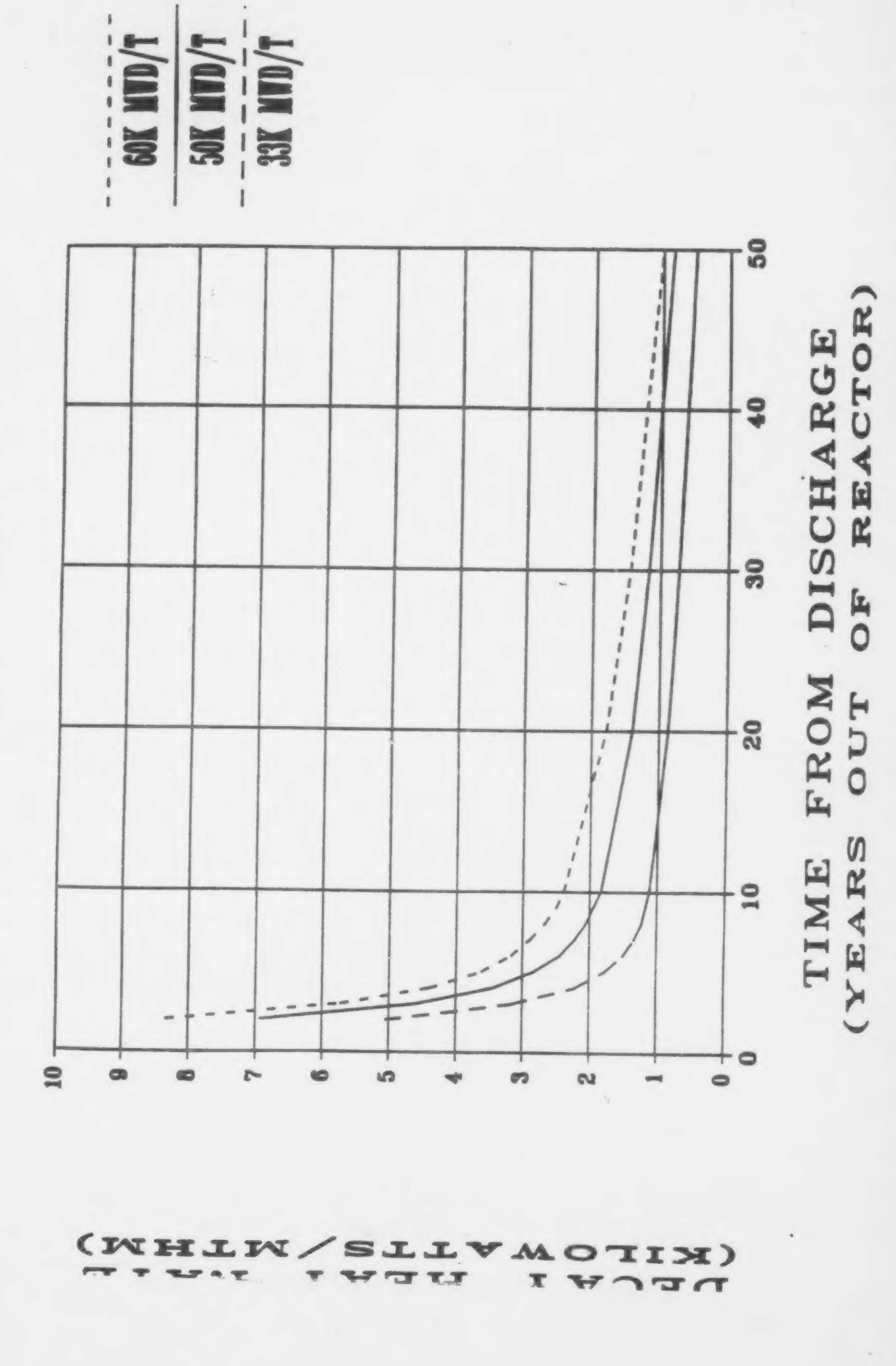
Mr. RUSCHE. I think that is right, but I would want to reserve on that number. It is of that order I think.

Senator EVANS. If we start with 10 year old fuel and the design of a repository and the amount of tonnage you can put in there, which is limited by law to 70,000 tons, if the fuel were 50 years old—now, you have said this only changes modestly the heat load. But in looking at the curves in estimating them as best I can, it is somewhere between one-third and maybe as much as one-half, but in other words, a pretty substantial difference between 10 and 50 in the heat load.

Mr. RUSCHE. I think that is right. I was just looking at some curves I have got here. Between 10 and 50 for 60,000 megawatt day per ton fuel, which is high exposure fuel, the ratio is not quite a factor of a third, but it is in that range. I have got some recent curves that we have developed. I would be glad to put those in your hands. But it is a significant factor.

[The information follows:]

SPENT FUEL DECAY HEAT



Senator EVANS. Well, what I want to do is get this in the record. But let's assume for the moment that the heat load is one-third. Can you translate that directly into saying that the material can be placed three times closer together, or three times as much in the acre?

Mr. RUSCHE. I think that is probably too simple, but it approximates that. In the end in the block of rock you have got a general limitation, as well as a near field.

Senator EVANS. I understand.

Mr. RUSCHE. And I am not sure the near field may not restrain it a little bit more.

Senator EVANS. But at least that is roughly the same thing.

Mr. RUSCHE. Yes.

Senator EVANS. That would have a considerable effect on the cost of the deep geologic repository, wouldn't it?

Mr. RUSCHE. It would have an effect, but the underground excavation is a relatively small fraction of the total cost of the repository program. And that is why I have repeatedly said that it is of the order of—not a factor of two or three, but of 10, 20, 30 percent or whatnot depending on where.

I think the biggest effect it would have is on the amount of tonnage that you could put in the same block of rock.

Senator EVANS. And couldn't that in turn—you know, if we were talking about a block of rock in the contemplation of a certain site based on 10 year old fuel that 70,000 tons could go there, and if the fuel was 50 years old and you could put 120,000 or 140,000 tons there in the same block with no more heat, no more residual radioactivity than were in the 70,000 tons, doesn't that suggest that we might very well then get by with a single repository rather than two?

Mr. RUSCHE. That has always been a consideration.

Senator EVANS. OK. If that is the case, then doesn't that suggest a very substantial cost savings?

Mr. RUSCHE. Well, it does if you make the cost savings in comparison with 10 year old fuel. But as I tried to suggest with Senator Hecht a while ago, the average—excuse me——

Senator EVANS. I understand.

Mr. RUSCHE [continuing]. The annual age of the fuel, as a matter of fact, is much greater than 10 years. And you do not build the repository to hold 70,000 tons of 10 year old fuel and then go put it——

Senator EVANS. I understand. But the design costs that you have calculated up to now have used that as the——

Mr. RUSCHE. They have indeed. And we made that very——

Senator EVANS. I am trying to get at the actual costs versus what were calculated.

Mr. RUSCHE. I just want people to be careful that they do not take an artificial base with which to compare and draw a cost savings implication because——

Senator EVANS. No, I understand. I understand that. But if we consciously say we have got an MRS, we've got a place to put this stuff, we are going to keep it for 50 years, and it flows through there, and you then can start from that point with the design of a deep repository knowing that you have no fuel younger than 50 years, you have got quite a different design problem.

Mr. **Rusche**. A portion of the design is certainly affected. But as I indicated, you design it as you go along——

Senator **Evans**. Yes, I understand.

Mr. **Rusche** [continuing]. To match the fuel and its heat.

Senator **Evans**. I understand that.

Mr. **Rusche**. The thing that I think——

Senator **Evans**. But the biggest potential, as I think you have already testified, is that under those circumstances we might well find that a single rather than two repositories——

Mr. **Rusche**. Even with the 70,000 ton—I mean, if the 70,000 ton arbitrary limit that is in the act were not there. That 70,000——

Senator **Evans**. If we had couched the 70,000 ton limit in different terms and we had translated 10 year old fuel times 70,000 tons as a heat load——

Mr. **Rusche**. It would have been a much more meaningful technical specification. The 70,000 tons was not put there for that reason I do not believe.

Senator **Evans**. Yes, that's right.

All right. If you could get that in a more definitive term on that comparison and, as well as you can do it, some estimate of what the cost considerations would be in two ways. If you had 50 year old rather the designed 10 year old and a 70,000 ton repository, how much in dollar terms do you think you could save? This is for the record. And then secondly, how much would be saved in the whole process if, in fact, that would allow you to put all of the waste in one repository rather than ultimately having to have two.

Mr. **Rusche**. The second piece is fairly easy to do. The first piece will take us a little while.

Senator **Evans**. That's fine.

Mr. **Rusche**. And I would hope that perhaps your question for the record would be phrased in a way that we might have the opportunity to do that and not be forced to give you something next week that is too much of a horseback estimate.

Senator **Evans**. I do not think any of these actually are going to pass next week.

[The information follows:]

To date, no detailed study has been performed which compares the cost of disposing of 50-year old fuel to that of disposing of younger fuel. As discussed below, reductions in heat production and radiation from spent fuel up to about 20 years out of reactor could lead to benefits in terms of repository size, shielding requirements, and transportation. However, beyond about twenty years out of reactor, the reductions in heat production and radiation diminish such that design and cost benefits at the repository are minimal. Since the average age of spent fuel to be received at the first repository is estimated to be about 20 years based on the reference schedule in the Mission Plan Amendment, the Department feels that there is little benefit to be gained by emplacing older fuel in the repository.

An examination of spent fuel heat decay curves (see attached figure) reveals that there are significant reductions in heat production and radiation up to about 20 years out of reactor. These reductions could lead to benefits in terms of repository size and reduced shielding requirements. In addition, there may be some anticipated savings in transporting older fuel. Beyond about 20 years out of reactor, the reductions in heat and radiation diminish such that design and cost benefits are marginal. At some point, the repository thermal constraints give way to physical constraints, such as minimum package spacing or waste package size constraints. Since the average age of spent fuel to be received at the first repository is about 20 years, the Department feels that there is little benefit to be gained by emplacing older fuel in the repository.

A study was performed to examine the cost impact of a 5-year additional delay to the reference program schedule. The total system cost for this case increased by $1.2 - $1.3 billion (1986 dollars) even though the repository cost portion decreased by $0.1 - $0.2 billion. Cost ranges reflect different assumptions of geologic media and site for the first and second repository.

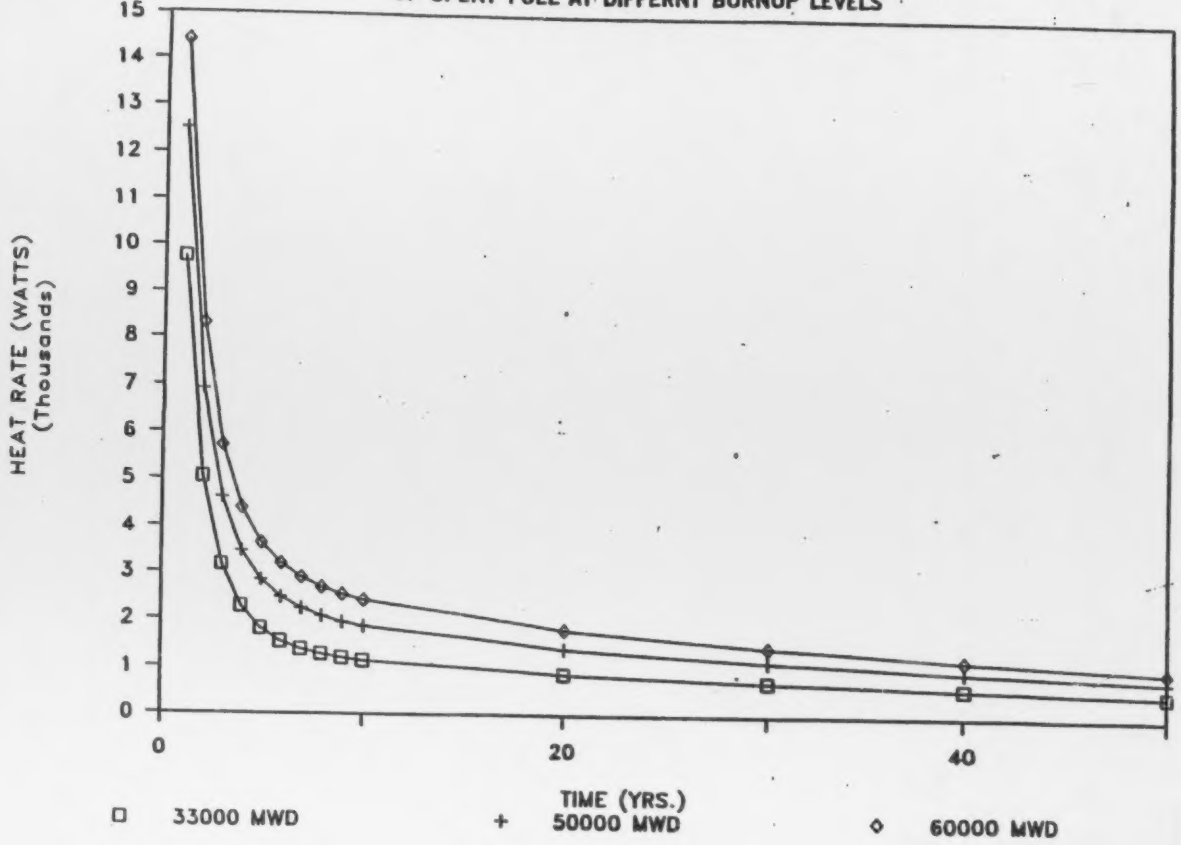
The cost increases result from additional development and evaluation costs associated with extending the program over 5 additional years. The analysis does not include any additional costs in the 5 year delay case for the extra 5 years of storage at utilities or at an MRS or ISFSI facility. The repository cost savings for the additional five years of aging are about one percent.

A case was also examined in which the previous Mission Plan schedule (1998 first repository and 2008 second repository) was assumed with the same waste generation projection. The average waste age in this case is about 12 years and there is a considerable amount of 5-year old spent fuel disposed of in the final years of both repository operations. In such a case, the average age decreases by about eight years from the proposed reference case in the Mission Plan Amendment (from 20 to 12 years). Total system costs decreased by $0.2 - $0.8 billion, or 10 percent. The system costs decrease is due to the decreased development and evaluation costs associated with the tighter schedule.

A distinction must be clearly made, then, between repository cost changes versus total system costs effects. Based on the three data points previously mentioned (1998, 2003, and 2008 start dates for the first repository), the trend indicated a decrease in repository cost when older fuel is emplaced that will be more than offset by increasing development and evaluation costs due to program extensions. The net effect is an increasing total system cost as average fuel age is increased--due to delays in repository start. This conclusion is valid even without accounting for the additional expense of at-reactor or MRS storage to attain additional fuel aging.

DECAY HEAT PATTERN FOR 1 MTU

OF SPENT FUEL AT DIFFERNT BURNUP LEVELS



Mr. **Rusche**. If I could just add a footnote. The thought of 50 year old fuel, as Senator Hecht and we have talked about, is not—it's not a bad idea. The thing in my opinion that is not necessary is to require that because there may be times when you want to load 20 year old fuel. And to make a determination by law that you cannot do anything for 50 years is not a sound public policy in my opinion.

Senator **Evans**. No. I would not suggest that ultimately that is what we ought to do in law. I think we ought to describe it in different terms and leave some flexibility. At least we are focusing on a certain aim and a certain set of policies that we want to achieve.

Mr. **Rusche**. And this discussion I think has been helpful in that regard in that we do find ourselves having to discuss this in a particular context constructed by the act and by surrounding circumstances. And in many cases these are somewhat artificial, but they are real nevertheless.

Senator **Evans**. That is what I would like very much to do is see if we can find a way to detach those artificial restraints and to reconstruct a policy act that really makes sense.

Mr. **Rusche**. My comments this morning were intended to be in that form.

Senator **Evans**. I appreciate it. Thank you very much.

Senator Hecht.

Senator **Hecht**. Just briefly. For the record, I have the testimony from Ron Lurie, Mayor of the City of Las Vegas, which I want to put in the record, and then also from symposium on the back end of the fuel cycle by Mr. Jean Lefevre. I cannot pronounce French.

Mr. **Rusche**. Jean Lefevre.

Senator **Hecht**. OK. Director of the French Atomic Energy Commission in charge of nuclear waste policy. I want to put this in the record. And I urge everyone to get the record and read this.

One small paragraph—I want to quote out of it.

> A final major argument in favor of reprocessing is, of course, long-term safety. With reprocessing and recycle, large quantities of plutonium are not left in the waste. The very small quantities of highly active and of long-lived radionuclides, including remaining traces, but traces only of plutonium, are given the extremely elaborate and expensive treatment which must be accorded to the whole of the spent fuel element if it is not to be reprocessed.

When I was talking to Senator Ford and I made a statement that energy is not political, I got a few laughs. But looking down the line in a few years when we have gas lines, there will be Democrats and Republicans in those gas lines. When the fuel bills go four, five, maybe ten times, there will be Republicans and Democrats both getting the same fuel. When we have plant closings, when we lose our competitiveness, we are going to look at energy and perhaps timing is very, very important.

The American people have got to look ahead and realize that nuclear energy is very viable. But before we can have a clear, safe understanding, we have to solve the problem of nuclear waste. And I think when these hearings are concluded, my contention is that it has been solved. And we can do it very, very effectively in America.

Again, Mr. Rusche, if your time permits, I would like for you to stay. A little later today Mr. Todorovich I see has just arrived from New York and will be testifying at a later time. He represents 1500 nuclear scientists and nuclear engineers. And I will be very anxious for his testimony to be in the record.

That's all, Mr. Chairman.

Mr. **Rusche**. Mr. Chairman?

Senator **Evans**. Yes, Mr. Rusche.

Mr. **Rusche**. Senator Hecht, I appreciate your invitation. I consider Mr. Todorovich a personal friend. I have had many opportunities to discuss the matter with him. I will not be able to stay, but I will promise you that he and I will discuss his testimony.

I would only note for you, even in Mr. Lefevre's statement, there is embedded a public policy consideration with which you in some of your other committee responsibilities are no doubt familiar. And that is, separating plutonium does not dispose of plutonium. And although the waste once separated does in fact have less long-lived material in it for disposal, the plutonium has to be managed in some way. And just as we are dealing with that in a number of environments in this country from a public policy and national security standpoint, our friends in France and other places in the world are likewise having to deal with that question. It is not as simple as we don't have it anymore. And I just urge you to keep that in the back of your mind as you are thinking about it.

Senator **Hecht**. I am fully aware of that, and I only recognized him by his picture. He was recommended to me by Dr. Teller who I have great confidence in. And I have no idea what he is going to say. I am only asking him as an independent scientist to address the different legislation which I have introduced.

Mr. **Rusche**. And I will be very interested in the commentary.

Senator **Hecht**. Thank you.

Mr. **Rusche**. Thank you. Thank you, Mr. Chairman.

Senator **Evans**. Thank you, Mr. Rusche, for an extensive period of time before the committee.

With that, we will call the next panel, the Honorable Dick Nelson from the House of Representatives of the State of Washington; Mr. Terry Husseman, Program Director, Office of Nuclear Waste Management, Governor's Office in Olympia, Washington; Mr. Michael Grainey, Deputy Director of Oregon Department of Energy in Salem, Oregon.

I might say just before we start this testimony that we will hold the record open until 5:00 p.m. Friday for questions that may be submitted by members to the various witnesses.

With that, let's start with Representative Nelson.

STATEMENT OF DICK NELSON, WASHINGTON STATE HOUSE OF REPRESENTATIVES

Mr. **Nelson**. Thank you very much, Senator Evans, Senator Hecht. It is a pleasure to be here.

I am chairman of the House Energy and Utilities Committee of the Washington State legislature, and I am also a member of my state's Nuclear Waste Board.

With me today and sitting behind me are five of my colleagues who this week have been talking with our congressional delegation on this most important subject. We have followed the hearings on the repository program with great interest, and we appreciate your invitation, Mr. Chairman, to testify today.

Of the several pieces of legislation before you this morning, we are most interested in the idea of regional monitored retrievable storage proposed by you, Mr. Chairman, S. 1266. To my knowledge you, Senator Evans, are one of the few public figures in this Nation willing to openly consider storing in his own state high-level nuclear waste generated elsewhere in the country. It is a risky position and one which all of us as elected officials can appreciate.

Earlier this spring 25 diverse members of the Washington State legislature wrote our congressional delegation urging support of a study of a regional monitored retrievable storage system, including a possible MRS on the Hanford Reservation. This letter is attached to my testimony.

However, it is imperative that any attempt to change the Nuclear Waste Policy Act take into account the unique situation in Washington State where a proposed repository site is surrounded by a Federal facility with high-level nuclear waste. Those wastes, defense wastes, some would describe as overflowing that facility.

A particular attraction for us of a regional MRS system is that it could open the way for the expeditious cleanup of those defense wastes currently at Hanford. There is no greater environmental concern in my state than the one posed by those wastes estimated to be 8,000 tons of uranium or the equivalent of about 16,000 canisters. And if we add the waste in the leaky single shell tanks to that figure, it climbs to more than 18,000 tons or approximately one-quarter of the capacity of the first repository.

So, a precondition for the State of Washington to participate in a national regional MRS program would be the cleanup of these wastes. At this point the Department of Energy and the State of Washington are reviewing possible solutions for the best final storage of these wastes. We need to consider the benefits and liabilities of temporary storage in an MRS facility, one which would allow us time to review our choices for final disposal.

Another consideration for a system of regional MRS is how many sites there will be. The legislation you have proposed would be improved we think if it would set up a system that is more truly regional perhaps with six or seven retrievable storage systems rather than three or four.

A national MRS system should reflect the political compromise in the Nuclear Waste Policy Act which called for a sharing of the risks and the responsibilities involved in the storage and disposal of nuclear wastes.

An important part of your proposal, Senator, is continued research into alternative disposal technologies. It has become clear in the debate over high-level nuclear waste disposal in this country and elsewhere that we simply lack sufficient information to feel confident in the deep geological option at this juncture. And I might add that in the State of Washington, the uncertainty I think has increased rather than narrowed since site characterization began.

In fact, the knowledge over what is the soundest way to store and ultimately dispose of waste is the reason why we have not at this time endorsed your proposal for a regional system. There is much in it that we find attractive, but we are convinced that we need more time to study all options.

And this is why the state's Nuclear Waste Board recently supported a moratorium on the repository program, to give us that time to evaluate the arguments about monitored retrievable storage and time to compare the MRS approach to at-reactor storage, as well as other alternatives.

The advantages of a moratorium are threefold in my opinion. First, it would provide us with the time to build the political consensus which is so sadly absent in this program today.

Second, a moratorium would provide time for Congress to assert its control over the United States Department of Energy, time to assure that state and tribal rights are protected.

Third, it would provide time to get the Department of Energy's national integrated contractor in place and up to speed. We need to have full confidence in both the contractor and the technology we are employing.

Now, no one expects that the moratorium would be like a steel door dropping on site characterization. In order to protect the information now being gathered, it is necessary to complete the scientific experiments under way in an orderly fashion. Of particular importance to Washington are the hydrology and seismic tests being conducted on the Hanford Reservation. When or if the repository program moves forward, this data will be available, essential. We will not need to begin the experiments anew.

We have heard commentary in the Congress that the states are suffering from the "not in my backyard" syndrome. I would like you to know—and I am sure you do, Senator Evans—that the Washington State legislature strongly supports a scientifically sound approach to the safe storage and disposal of high-level nuclear waste, both commercial and military in origin.

Our State legislature and three different governors have never taken a position in opposition to a repository when decisions are based on scientific considerations. But we have very frankly been disappointed with the implementation of the program by the Department of Energy. Their decisions have seemed to us to be politically motivated from the very beginning predating the Nuclear Waste Policy Act and continuing on since passage of the act.

The simple truth is that the Department of Energy has not yet earned the confidence of the people in Washington State that it is using the best that science has to offer in pursuing the siting of a repository.

In conclusion, we believe it is necessary for the Congress, together with the states, affected Indian tribes, and the Federal executive branch, to use the next 18 months or so to gain back public trust for the Nation's nuclear waste storage program. We need to reexamine the pros and cons of deep geological disposal, regional monitored retrievable storage, and at-reactor storage. We need to free the program of its unfortunate political overtones. We need to create a program administration which is responsive to state and tribal concerns. And most of all, we need to assure the people of this country that we are selecting the safest disposal alternative.

Thank you.

[The prepared statement of Mr. Nelson follows:]

STATEMENT OF REPRESENTATIVE DICK NELSON

STATE OF WASHINGTON

to the

UNITED STATES SENATE

COMMITTEE ON ENERGY AND NATURAL RESOURCES

July 16, 1987

Mr. Chairman, members of the Committee,

My name is Dick Nelson. I am Chairman of the House Energy and Utilities Committee of the Washington State Legislature. I am here today with a delegation of Washington State legislators who flew out earlier this week to discuss the repository program with our congressmen and with this committee. Our legislature has not been included in congressional hearings on the repository program this year, though we have followed the hearings with great interest. We appreciate your invitation, Mr. Chairman, to testify today.

Of the several pieces of legislation before you this morning, we are most interested in the idea of regional monitored retrievable storage proposed by Senator Evans. The Senator's proposal is a bold one. It has been the subject of substantial discussion and debate among legislators. To my knowledge, the Senator is one of the few public figures in the nation who is willing to openly consider storing in his own state high-level nuclear wastes generated elsewhere in the country. It is a risky position, and one which all of us, as elected officials, can appreciate.

Earlier this spring twenty-five members of the Washington State Legislature wrote our congressional delegation urging them to support a study of a regional monitored retrievable storage system -- including a possible MRS on the Hanford Reservation. This letter, which is attached to my testimony, was signed by Republicans and Democrats, Senators and Representatives, eastern and western Washingtonians. It is a reflection of the political attitude in Washington State that we are willing to do our part in the storage and disposal of the country's high-level wastes, as long as those decisions are based on the best scientific and technical analysis available.

However, it is imperative that any attempt to change the Nuclear Waste Policy Act take into account the unique situation in Washington State, where we have a federal facility filled with high-level defense wastes surrounding the proposed repository.

A particular attraction for us of a regional MRS system is that it could open the way for the expeditious cleanup of these defense wastes currently at the Hanford Reservation. There is no greater environmental concern in the state than the one posed by these wastes. The Department of Energy estimates that 8,000 metric tons of uranium, or the equivalent of 16,000 canisters of defense high-level wastes, are on the Reservation. If we include the wastes from the leaking single shell tanks to this figure, it climbs to more than 18,000 metric tons of high-level waste. These wastes would fill a quarter of the capacity of a first repository.

A precondition for the State of Washington to participate in a national regional MRS program would be clean up of these wastes. At this point, the Department of Energy and the State of Washington are reviewing possible solutions for the best final storage of these wastes. We need to consider the benefits and liabilities of temporary storage of these wastes in a safe facility, one which would allow us to review our choices for final disposal.

Another consideration for a system of regional monitored retrievable storage is how many sites there will be. The legislation before you would be improved if it would set up a system that is more truly regional, perhaps with six or seven sites rather than three or four. A national monitored retrievable storage system should reflect the political compromise in the Nuclear Waste Policy Act which called for a sharing of the risks and responsibilities involved in the storage and disposal of nuclear wastes. Washington State legislators have already indicated their interest in a potential MRS facility if it were solely for the Northwest states, and if it would assure cleanup of defense wastes on the Hanford Reservation.

An important part of the Evans' proposal is continued research into alternative disposal technologies. It has become clear in the debate over high-level nuclear waste disposal in this country, and elsewhere, that we simply lack sufficient information to feel confident in the deep geologic option at this juncture. Every time we have tried to store nuclear waste underground, we have regretted it. What we need, it seems, is a more flexible approach to the problem, one which can adapt improvements in technology as they come along. A national policy of such importance should not go beyond the state of our knowledge to something we think we will learn in the next decade or two.

In fact, lack of knowledge over what is the soundest way to store and ultimately dispose of the waste is the reason why we cannot endorse Senator Evans' bill at this time. There is much in it that we find attractive, but we are convinced that we need more time to study our options.

This is why the state's Nuclear Waste Board recently supported a moratorium on the repository program, to give us time to examine the ramifications of Senator Evans' proposal, time to evaluate the arguments about monitored retrievable storage which have emerged in Tennessee (particularly those pertaining to transportation cost and safety, and hot cell technologies), and time to compare monitored retrievable storage to at-reactor-storage.

The advantages of a moratorium are several:

First, it would provide us the time to build the political consensus which is so sadly absent in this program today. Some people wonder if it will ever be possible to build this support. It is worthwhile to make the attempt. The time needed to build public confidence is insignificant compared to the time the public will have to deal with a repository.

Second, a moratorium would provide time for Congress to assert its control over the United State Department of Energy; time to assure that state and tribal rights are protected.

Third, it would provide time to get the Department of Energy's national integrated contractor in place and up to speed; time for a more deliberate approach to the complex technical problems involved in this program. We in Washington State are painfully familiar with the problems which accompany large scale nuclear projects being engineered as they are being constructed. We believe it is unwise to push forward until the proper expertise is available and in place. We need to have full confidence in both the contractor and the technology we are employing.

No one expects that a moratorium will be like a steel door slamming shut on the work now going on. In order to protect the information now being gathered, it is necessary to complete the scientific experiments underway in an orderly fashion. Of particular importance to Washington are the hydrology and seismic tests being conducted on the Hanford Reservation. These tests will tell the scientists a great deal about the rate and direction of groundwater flows, and the risks in storing or disposing of wastes close to the Columbia River. When, or if, the repository program moves forward, this data will be available; we won't need to begin the experiments anew. In a program where we have spent nearly a billion dollars already, I would hope that we could begin to be more attentive to reasonable and unreasonable costs.

We have heard commentary in the Congress and in this committee that the states are suffering from the "not-in-my-backyard" syndrome; that the problems in the repository program are primarily political rather than technical. I would like you to know that the Washington State Legislature strongly supports a scientifically sound approach to the safe storage and disposal of high-level nuclear wastes. We have always been responsive to scientifically based alternatives. The state Legislature and three different governors have never opposed the repository when decisions are based on scientific considerations.

But we have been disappointed in the implementation of the program by the Department of Energy. Their decisions have seemed to us to be politically motivated from the very beginning, predating the Nuclear Waste Policy Act and continuing on since passage of the act.

The simple truth is that the Department of Energy has not yet earned the confidence of the people in Washington State that it is using the best that science has to offer in pursuing the siting of a repository.

We believe it is necessary for the Congress, together with the states, affected Indian tribes, and the federal executive branch to use the next eighteen months or so to gain public trust for the nation's nuclear storage policy. After our experience of the last several years, we need to reexamine the pros and cons of deep geologic disposal, regional monitored retrievable storage, and at-reactor-storage. We need to free the program of its unfortunate political overtones. We need to create a program administration which is responsive to state and tribal concerns. And most of all, we need to assure the people of this country that we are selecting a technology which is safe today and can be made even safer in the years to come.

WASHINGTON STATE LEGISLATURE
Senate • House of Representatives • Legislative Building • Olympia, Washington 98504

May 11, 1987

(Letters sent to
all of Washington
state's delegation.)

The Honorable Brock Adams
United States Senator
513 Hart Senate Office Building
Washington, D. C. 20510

SUBJECT: Nuclear Waste Policy Act

Dear Senator Adams:

There is now substantial evidence that the Nuclear Waste Policy Act is not working as planned. The nation is struggling to find a politically acceptable course for the long-term disposal of high-level nuclear waste. The time has come to revise the Act. We believe it might be fruitful to focus on a shorter term solution which keeps our long term options open. This solution could be a national regional system of Monitored Retrievable Storage. If done correctly, there could be substantial benefits to the state of Washington with such a system.

A study of a potential regional Monitored Retrievable Storage system would be worthwhile for Washington for these reasons:

1. Despite the best congressional intentions, defense waste cleanup is proceeding too slowly. Siting of an MRS facility at Hanford would provide leverage for cleanup of the defense wastes located on the Reservation.

2. The proposed cutback in nuclear production at Hanford, including USDOE's projection for the N Reactor going off line in 1995, could lead to a loss of interest by USDOE in cleaning up the Reservation. Not only would an MRS help assure cleanup, it would also provide jobs for workers who might lose their production jobs. We estimate operating an MRS could provide as many as 1,200 jobs per year.

3. The nation is at a political impasse in the siting of a repository. Recent proposals include forcing a repository on a state which is bitterly opposed to it. This is not the basis for good policy making. If Washington were to participate in an interim solution for handling high-level waste through an MRS, this might help ease the way for a cooperative approach by other states to address this severe national problem.

4. In fact, the country just does not seem ready for the siting of a permanent repository. We might be far better off taking a modified approach, along the lines we see in Europe. The European model of interim storage of high level wastes seems to have avoided the public outrage which haunts our national search for a permanent repository.

5. An MRS at Hanford would accept wastes generated in the Northwest region, including WNP-2, Trojan, and the Idaho National Engineering Laboratory, as well as the defense wastes on the Hanford Reservation. The additional transportation risks to Washington associated with such a project would be small. A national regional system would reduce transportation risks for the foreseeable future, when compared to the current USDOE scenario of a single eastern MRS and a permanent Western repository.

6. Regional storage of high-level waste has the simple, but compelling, notion of equity. Those parts of the country which benefit from nuclear power, and also generate wastes, should also own the responsibility for the safe storage of those wastes. Pitting the Eastern United States against the West, which seems to be our national policy, is not a responsible approach. Wastes should be handled by those who generate them.

We recognize, of course, that there are substantial risks involved in a regional MRS system, and in particular, siting a combined defense and commercial MRS at Hanford. Nevertheless, we believe that the idea warrants a hard look. We were pleased to note that Congressman Morrison recently persuaded a House Subcommittee on Energy Research and Development to add $5 million to an authorization bill for the study of a regional MRS.

We urge you to support this approach.

Thank you for your attention to our request. We look forward to learning your thinking on this matter.

Sincerely,

[illegible] E. Berg — Dick Nelson

Shirley Hankins — Dick Barnes

Peter T. Brooks — Jolene Unsoeld

Letter to Senator Adams
May 11, 1987
Page 3 of 6

Jim Jesernig

Lois Stratton

Cliff Bailey

Jerry Saling

R. J. Gallagher

Fred H. May

Irv Newhouse

Mike Todd

Seth Armstrong

Nancy Rust

Ken D. Jacobsen

Louise Miller

John A. Moyer, M.D.

Susan Wilson

Emilio Cantu

Bill Brumsickle

Gary A. Nelson

Alan Bluechel

R. Brad Owen

Signatories

Senator Max E. Benitz
Representative Shirley Hankins
Representative Peter T. Brooks
Representative Jim Jesernig
Senator Lois J. Stratton
Senator Cliff Bailey
Senator Jerry Saling
Representative P.J. Gallagher
Representative Fred O. May
Senator Irv Newhouse
Representative Mike Todd
Representative Seth Armstrong
Representative Nancy Rust
Representative Dick Nelson
Representative Dick Barnes
Representative Jolene Unsoeld
Representative Ken G. Jacobsen
Representative Louise Miller
Representative John A. Moyer
Representative Sim Wilson
Senator Emilio Cantu
Senator Bill Smitherman
Senator Gary A. Nelson
Senator Alan Bluechel
Senator Brad Owen

Senator EVANS. Thank you very much, Representative Nelson.

Let me just say at this moment that if there has ever been a more dramatic document in relationship to this entire program than the letter you have submitted on behalf of the Washington State legislature, I do not know what it would be.

You talk about the lack of political consensus. That certainly has dramatized this program from beginning to the current point. And yet, I know the members of the legislature who have signed that letter. And as you said at the beginning, they represent not only both political parties but an extraordinarily wide range of political philosophies, people from rural and urban areas, those who represent the districts right around Hanford, those who represent the cities.

I think it is a remarkable document and it could end up I think being a very, very substantial step forward in the process that we must go through. I congratulate you and your colleagues for being willing to put something like that together.

Mr. NELSON. Thank you.

Senator EVANS. Mr. Grainey, did you have anything you wish to add further to the statement that you had to read earlier before we get to questioning?

Mr. GRAINEY. No, Senator. I would be happy to answer any questions you have, but I have no further prepared remarks.

Senator EVANS. Fine.

Mr. Husseman, would you like to testify?

STATEMENT OF TERRY HUSSEMAN, PROGRAM DIRECTOR, OFFICE OF NUCLEAR WASTE MANAGEMENT, GOVERNOR'S OFFICE, OLYMPIA, WA

Mr. HUSSEMAN. Thank you, Mr. Chairman.

On behalf of Governor Gardner we appreciate the opportunity to provide the State of Washington's comments on the four bills which you are considering today.

Our comments on these bills are made in the context of the State of Washington's overall position on the high-level nuclear waste storage and disposal program. As we have previously testified to this committee, the State of Washington urges Congress to bring the repository site-specific activities to a temporary halt. A pause in the program would provide the opportunity to seek a consensus among the various interests as to the preferred course of action which will lead to a timely solution of the utilities' short-term spent fuel storage problem, define the elements of an equitable site selection process that will provide confidence the search will be for the best scientifically acceptable site, and insure that site selection decisions will be based on credible scientific evidence.

We believe that the record established in this and other committees demonstrates that there is widespread agreement that such congressional action is needed to restore credibility to the program.

Each of the four bills before you today proposes amendments to the Nuclear Waste Policy Act of 1982. There are several proposed changes contained in these bills which we support, and in some instances we are already on the record proposing similar courses of action.

However, in our opinion it is not productive to follow a piecemeal approach in amending the Nuclear Waste Policy Act. What is needed is a comprehensive approach which deals with all of the major unresolved issues as part of a package. At this point there is not a consensus in Congress as to the preferred comprehensive solution to the problems which now face us due to the flawed implementation of the act.

We believe that given a proper forum, adequate time and good faith participation among the representatives of the various interests, it is possible to reach a consensus as to an approach which will restore confidence that the goals of the act can in fact be achieved.

I would like to comment briefly on several proposals contained in the four bills before this committee. Our recommendation, however, is that many of these ideas could be included in the consensus-building process which we encourage Congress to establish before the end of this session.

Taking first the overall restructuring of the site selection process, the restructured site selection process spelled out in Senate Bill 1266 is consistent with a proposal contained in Governor Gardner's testimony to the Senate Subcommittee on Energy Research and Development in June of last year in that it calls for a restart of the site selection process. It calls for a nationwide search for a suitable site. It eliminates the unachievable statutory deadlines. And it calls for a study of the need for the second repository.

We continue to support this general approach, and we would like to take this opportunity to express our appreciation to Senator Evans for introducing this legislation which includes the approach to the site selection process. We believe that if this approach could be linked with an agreement as to the preferred methodology to solve the nuclear utilities' short-term spent fuel storage problem, the foundation of a comprehensive solution to the nuclear waste storage and disposal would be established.

The second issue that is covered in the bills is the reprocessing issue. This issue of whether or not to reconsider the policy related to reprocessing commercially generated spent nuclear fuel is a national issue. The State of Washington takes no position on this question. We do not oppose the proposed feasibility study on this issue which could be carried out contemporaneously with the consensus-building process to look at the entire program.

The third issue contained in two of the bills relates to research on subseabed disposal option. The state supports the national policy of investigating the technical feasibility of deep geologic burial as the preferred permanent solution to the Nation's high-level nuclear waste disposal problem.

At the same time we have urged Secretary Herrington to restore funding of research into the feasibility of subseabed disposal as a potential backup to deep geologic burial. We continue to support funding of research of the feasibility of the subseabed option. In fact, it is our impression that the Nuclear Waste Policy Act expressed congressional intent that DOE continue to look at other options, and we so indicated in our letter to Secretary Herrington.

As to the issue of participation by adjoining states, the state supports full participation by the State of Oregon in the site selection process so long as the Hanford site is under consideration. Oregon has shown intense interest and made valuable contributions to the site selection process since its inception in 1983.

Congress has demonstrated its recognition of Oregon's right to participate by providing $2½ million in funding over the period of proposed site characterization.

The precise criteria for adjoining state and perhaps corridor state participation in the site selection process and the nature and extent of their participation are issues which also could be considered as part of the consensus-building process during the moratorium.

As to economic incentives for potential host state and local governments, the state also supports the concept that economic incentives should be provided to the state and local governments in which potential sites for a high-level nuclear waste repository have been selected for site characterization. The primary focus of the process, however, must be to select the best scientifically acceptable sites. Once the search has been narrowed pursuant to a credible scientifically based process, the state and local governments should begin to receive fair and adequate economic incentives.

Appropriate timing and levels, as well as mechanisms for payment of these incentives to local and state governments, are issues which also could be considered during the moratorium and built into the bill which would come out of that process.

Finally, the issue of the solution to the nuclear utilities' short-term problem. Obviously, as part of the comprehensive solution to the high-level waste problem, Congress must establish a policy as to the preferred methodology for temporary storage of commercially generated spent nuclear fuel.

What is the best approach? Is it the MRS facility proposed by DOE? Or is it a system of regional MRS facilities? Or would at-reactor dry cask storage be the best option?

Does short-term storage or long-term storage of spent nuclear fuel make more sense?

Currently opinion is split as to the best answers to these questions. It is crucial that a concentrated effort be made to reach a consensus on the preferred course of action and that Congress establish the preferred course of action as a national policy. Such a policy is a necessary element of the comprehensive package which can provide direction and restore confidence in the ultimate success of the program.

We recommend that if Congress does elect to adopt the moratorium approach, the commission, which is empaneled to direct the process during the moratorium, should be instructed to compare and evaluate the relative merits and shortcomings of the several proposed spent fuel storage options. The commission should be required to recommend to Congress the methodology that will best solve the utilities' short-term problem while also contributing to successful permanent disposal.

We suggest that the commission utilize the following criteria in comparing and evaluating the alternative spent fuel storage methodologies. First is the alternative technically achievable with a high level of confidence that it is acceptably safe? This, of course, is a threshold question which must be answered yes before an alternative would merit further consideration.

Second, is one of the alternatives significantly safer than the others?

Third, what are the comparative effects on overall nuclear waste storage and disposal system costs?

Fourth, what are the likely impacts of each alternative on achievement of permanent disposal?

The commission should be provided with sufficient resources to conduct independent analyses as to these relevant issues. In addition, representatives of the various interests should have the opportunity to present their points of view and the supporting rationale to the commission. If the process is conducted fairly and openly, and there is an adequate opportunity for full participation, the final recommendation of the commission should be acceptable to those who participate with a good faith intent to solve the high-level waste problem.

On behalf of the citizens of the State of Washington, we thank you for the opportunity to present our perspective on these issues and look forward to working with this committee in seeking the final solution to the nuclear waste disposal problem.

[The prepared statement of Governor Gardner follows:]

TESTIMONY OF GOVERNOR BOOTH GARDNER
STATE OF WASHINGTON
to the
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
July 16, 1987

Thank you Chairman Johnston and members of the Committee. I appreciate the opportunity to provide the state of Washington's comments on the four bills which you are considering today.

Our comments on these bills are made in the context of the state of Washington's overall position on the high-level nuclear waste storage and disposal program. As we have previously testified to this Committee, the state of Washington urges Congress to bring all repository site-specific activities to a temporary halt. A pause in the program would provide the opportunity to seek a consensus among the various interests as to the preferred course of action which will:

- lead to a timely solution of the nuclear utilities' short-term spent fuel storage problem;
- define the elements of an equitable site selection process that will provide confidence the search will be for the best, scientifically acceptable site; and
- ensure that site selection decisions will be based on credible scientific evidence.

We believe that the record established in this and other committees demonstrates that there is widespread agreement that such Congressional action is needed to restore credibility to the program.

Each of the four bills before you today proposes amendments to the Nuclear Waste Policy Act of 1982. There are several proposed changes contained in these bills which we support and, in some instances, we are already on the record proposing similar courses of action. However, in our opinion, it is not productive to follow a piecemeal approach in amending the NWPA. What is needed is a comprehensive approach which deals with all of the major unresolved issues as part of a package. At this point, there is not a consensus in Congress as to the preferred comprehensive solution to the problems which now face us due to the flawed implementation of the

NWPA. We believe that given a proper forum, adequate time, and good faith participation among representatives of the various interests, it is possible to reach consensus as to an approach which will restore confidence that the goals of the NWPA can be achieved.

I will comment briefly on several of the proposals contained in the four bills which you are considering today. My recommendation, however, is that many of these ideas be included for discussion during a consensus-building process, which I urge Congress to establish before the end of the current session.

Restructuring the Repository Site Selection Process

The restructured repository site selection process contained in S.1266 is consistent with a proposal contained in my testimony to the Senate Subcommittee on Energy Research and Development on June 16, 1986, in that it:

- calls for a restart of the site selection process;
- calls for a nationwide search for a suitable site;
- eliminates unachievable statutory deadlines; and
- calls for a study of the need for a second repository.

We continue to support this general approach. I want to take this opportunity to express my appreciation to Senator Evans for introducing legislation which includes this approach to the site selection process. I believe that if this approach could be linked with an agreement as to the preferred methodology to solve the nuclear utilities' short-term spent fuel storage problem, the foundation of a comprehensive solution to the nuclear waste storage and disposal problem would be established.

Study of the Feasibility of Reprocessing Spent Nuclear Fuel

The issue of whether or not to reconsider the policy related to reprocessing commercially-generated spent nuclear fuel is a national issue. The state of Washington takes no position on this question. We do not oppose a feasibility study on this issue which could be carried out contemporaneously with the nuclear waste program consensus-building process.

Research on Alternatives to Deep Geologic Burial

The state of Washington supports the national policy of investigating the technical feasibility of deep geologic burial as the preferred permanent solution to the nation's high-level nuclear waste disposal problem. At the same time, we have urged Secretary Herrington to restore funding of research into the feasibility of subseabed disposal as a potential backup to deep geologic burial. We continue to support funding of research of the feasibility of the subseabed disposal option.

Participation By Adjoining States

The state of Washington supports full participation by the state of Oregon in the site selection process, so long as the Hanford site is under consideration. Oregon has shown intense interest and made valuable contributions to the NWPA site selection process since its inception in 1983. Congress has demonstrated its recognition of Oregon's right to participate by providing $2.5 million in funding over the period of proposed site characterization.

The criteria for adjoining state and corridor state participation in the site selection process, and the nature and extent of their participation, are issues which should be considered as part of the nuclear waste program consensus-building process.

Economic Incentives for Potential Host State and Local Governments

The state of Washington supports the concept that economic incentives should be provided to state and local governments in which potential sites for a high-level nuclear waste repository have been selected for site characterization. The primary focus of the process, however, must be to select the best, scientifically-acceptable sites. Once the search has been narrowed pursuant to a credible, scientifically-based process, the state and local governments should begin to receive fair and adequate economic incentives.

Appropriate timing and levels, as well as mechanisms for payment of economic incentives to state and local governments, are issues which should be considered and resolved during the consensus-building process.

Solution to Nuclear Utilities' Short-Term Spent Fuel Storage Problem

As part of the comprehensive solution to the nation's high-level waste problem, Congress must establish a policy as to the preferred methodology for temporary storage of commercially-generated spent nuclear fuel. What is the best approach? Is it --

- The MRS facility proposed by USDOE?
- A system of regional MRS facilities?
- At-reactor dry cask storage?

Does short-term storage or long-term storage of spent nuclear fuel make more sense?

Currently, opinion is split as to the best answers to these questions. It is crucial that a concentrated effort be made to reach consensus on the preferred course of action and that Congress establish the preferred course as national policy. Such a policy is a necessary element of the comprehensive package which can provide direction and restore confidence in the ultimate success of the nuclear waste storage and disposal program.

We recommend that if Congress elects to adopt the moratorium approach, the Commission which is empaneled to direct the consensus-building process during the moratorium should be instructed to compare and evaluate the relative merits and shortcomings of the several proposed spent fuel storage options. The Commission should be required to recommend to Congress the methodology that will best solve the nuclear utilities' short-term spent fuel storage problem, while also contributing to successful permanent disposal.

We suggest that the Commission utilize the following criteria in comparing and evaluating the alternative spent fuel storage methodologies:

1. Is the alternative technically achievable with a high level of confidence that it is acceptably safe? This, of course, is a threshold question which must be answered "yes" before an alternative would merit further consideration.
2. Is one of the alternatives significantly safer than the others?
3. What are the comparative effects on overall nuclear waste storage and disposal system costs?
4. What are the likely impacts of each alternative on achievement of permanent disposal.

Conduct of the Commission's Work

The Commission should be provided with sufficient resources to conduct independent analyses of the relevant issues. In addition, representatives of the various interests should have the opportunity to present their points of view and the supporting rationale to the Commission. If the consensus-building process is conducted fairly and openly, and there is adequate opportunity for full participation, the final recommendation of the Commission should be acceptable to those who participate with a good faith intent to solve the nation's nuclear waste problem.

On behalf of the citizens of the state of Washington, thank you Chairman Johnston and members of the Committee for the opportunity to present our perspective on these important issues. We look forward to working with the Committee to find a solution to the nation's high-level nuclear waste disposal problem.

Senator EVANS. Thank you very much, and I thank the entire panel.

First, Mr. Husseman, does the State of Washington or the executive branch endorse the concepts set forward in the joint letter that was signed by members of the legislature?

Mr. HUSSEMAN. As indicated in the testimony, Senator Evans, the Governor and the Nuclear Waste Board are supporting a study basically to determine what is the best short-term solution as far as storage of spent nuclear fuel.

To the extent that—my recollection of the letter—it does recommend that regional MRS be studied as to whether it is an appropriate or the best solution to that problem. And I think we are basically on the same wavelength.

I think there are several options out there. There are proponents of all of them. I do not think that at this point one can say with much certainty as to what is the best. So, we support a study, which I do not think would take that long, to compare the alternatives and pick the best one.

Senator EVANS. Is it necessarily a question of the best one? There are three alternatives you mentioned in your letter, the MRS facility proposed by USDOE or a system of regional MRS facilities or at-reactor dry cask storage.

I think it is probably accurate to say that the legislation I have introduced would be amenable to any one of the three, that it does call for regional MRSs and it does say four, but it certainly is amenable to the suggestion that maybe not all four are necessary, maybe three, maybe two, maybe one, which gets you back to the MRS concept of the USDOE. And it does specifically call for the alternative of dry cask storage at-reactor sites if the utilities can prove that that is an acceptable and safe alternative.

Mr. HUSSEMAN. Senator Evans, it may very well be that very short-term solution that you are proposing in your bill is the one that a consensus will gather on. I do not know that there is a consensus at this point on any of the options. If you look at what——

Senator EVANS. That is absolutely right.

Mr. HUSSEMAN. If you look at DOE's proposal, which they defend very strongly, and then you read the comments by the State of Tennessee—and of course, I kind of think of this like in the terms of—you know, just because you are paranoid does not mean that no one is after you. I mean, Tennessee can be—we have the same problem in the State of Washington. I think we raise, valid technical concerns and we get accused of just playing "not in my backyard."

Well, I am sure Tennessee has some of the same problems. But if you read their report, I think they raise some valid questions. And the General Accounting Office raises some of the same questions about DOE's proposal.

There are those that are saying the best answer and the most—you know, it will be safer and cheaper—would be just to store it all at the reactors until the repository is ready.

We do not have any position as to the best solution at this point. And as I said, it may be something very close to what is proposed in your legislation.

Senator EVANS. Would you say that really the concern is significantly higher, however, over the uncertainties related to a deep geologic storage than any one of the several alternative interim storage facilities?

Mr. HUSSEMAN. Yes, I would agree with that.

Senator EVANS. Yes. Would both of the other two of the panel agree that the much larger uncertainty is all of the problems surrounding the deep and long-term geologic storage as opposed to the interim storage?

Mr. GRAINEY. Yes, sir.

Senator EVANS. Mr. Husseman, again, the questions that you mention on page 4 I think are good questions. I am not so sure that all four of them require an extensive analysis or commission to determine the answers.

The first one, "Is the alternative technically achievable with a high level of confidence that is acceptably safe?" That obviously is a threshold question. But it seems to me based at least on significant experience that is already under way and has some history behind it in other nations that the answer to that one probably pretty clearly is yes.

Mr. HUSSEMAN. I would agree. If you are looking at three options, the first thing you want to know is are they——

Senator EVANS. Sure. I understand that. I am just trying to determine kind of——

Mr. HUSSEMAN. I know where you are going.

Senator EVANS [continuing]. What level of concern we have about each of these questions. It seems to me we may not have absolutely answered it for a particular design or series of designs, but in general terms we have got some pretty good experience out there that tells us that this can be done and accepted.

"Is one of the alternatives significantly safer than the others?" That is a useful question although probably the answer will be not necessarily, that you can make each of these alternatives—certainly there is probably not a great deal of difference between a single MRS and regional MRSs in terms of the site itself. There may be some differences in the transportation systems necessary to bring them either to a single site as opposed to four sites.

Mr. HUSSEMAN. Right. I think if I were answering these questions right now—and I have not done much analysis of the issue——

Senator EVANS. I understand.

Mr. HUSSEMAN [continuing]. I would answer the first one probably yes and the second one probably no because you can always build in enough safety into any one of these to make them equivalently safe. And then you get to the next question which is how much does it cost to get there.

Senator EVANS. Yes. And that probably even with information we have now is—as long as you can define the alternatives, the comparative effects on cost are probably fairly readily determinable, it would seem to me.

Mr. HUSSEMAN. I think there is disagreement on the answer to that question. But I think there is information out there that could be analyzed.

Senator EVANS. It's the fourth question that is perhaps the most interesting. "What are the likely impacts of each alternative on achievement of permanent disposal?" I guess if I were to answer that question right now, I would say who the heck knows.

Mr. HUSSEMAN. Well, since the ultimate goal of the act is permanent disposal, and since—I agree with your concept that if we can solve the short-term problem, the fact that it takes a few extra years to build the repository is not that big of a problem. But if the ultimate goal is a safe repository, I think you need to look at each of these and say, okay, what impact would that have on the ultimate solution.

Senator EVANS. Sure.

Representative Nelson, we had quite a discussion, which I am sure you heard, between myself and Mr. Rusche on this interconnect between the final approval of a deep geologic storage and the beginning of an MRS. Do you think—if we had a law and ultimately came up with a law that very specifically put things in order that said we want to do interim work first and that we have some timetables that we are going to carry out to reach final deep geologic storage that with that kind of an act crafted, could you decouple or do you believe that we ought to decouple those two and go ahead with the first one while we are still making final decisions on the final one and not have to wait until all of that work is done before you can even start the MRS?

Mr. NELSON. That certainly is sensible, Senator. I know of no one in our legislature who would dispute that.

It seems to me that the Department's position is too rigid. They, as Mr. Rusche indicated, fear a blockage of the program. We do not wish to block the program. We believe there has to be a final solution. We believe if we are planning for 50 generations or 500 generations, as we are, we should take the time, a few years, to find the best solution. And the MRS could allow us the time to do that. It is as simple as that.

And I think that to suggest that—I am sure there are people that want to stop nuclear power and maybe they see this as an opportunity. But they do not prevail in the State of Washington. And we believe that an MRS approach has a lot of merit and should be looked at at the same time we are looking at the ultimate solution.

Senator EVANS. Mr. Husseman, how about that same question as far as you are concerned? The decoupling as long as you have the whole concept from beginning to end of the cycle encompassed and specifically set forth with timetables in a law.

Mr. HUSSEMAN. If we were at this point trying to put together the consensus package, I would think that coupling the MRS to the repository would not make sense in my opinion.

Now, I can understand why Tennessee wants it——

Senator EVANS. I understand.

Mr. HUSSEMAN [continuing]. Given the way the program has gone up to this point. I am sure they have as little confidence in where DOE is going as we do. And so, you know, I certainly understand why they want it at this point.

But if the program is set up properly and there is more confidence that it is going to go forward and work, perhaps that linking won't even be necessary to the state where the MRS might be located.

Senator EVANS. You suggest we might even get to that happy point where we find that there is more than one technically feasible site for an MRS and the combination of better knowledge and better confidence and financial incentives might make this even a competitive process. It would be a happy occasion, but we are a long way from there yet.

Mr. HUSSEMAN. Yes, you never can tell.

Senator EVANS. Senator Hecht.

Senator HECHT. No questions. Thank you.

Senator EVANS. Thank you. Thank you very much, all of you.

I do think that when we start to examine the testimony and develop the materials that we will need to take with us to the next stage in what we do in Congress, we will certainly find that the testimony that has been given here and particularly the letter—I would come back to it. I am struck by the first time that I have ever found such a wide spectrum of people who are in the political field and who understand all of the political, as well as the scientific nuances, willing to gather together on a single and I think very positive proposal. And I think that may well be the key toward unlocking this puzzle that we have got.

We thank you very much.

The next panel is Mr. Dean Tousley, Attorney, Harmon and Weiss, Washington, DC, on behalf of the Yakima Indian Nation; Mr. Del White, Chairman of the Nez Perce Tribal Executive Committee; Mr. Bill Burke, Manager, Nuclear Waste Study Program, Confederate Tribes of the Umatilla Indian Reservation in Pendleton, OR.

We appreciate your appearance. We do have all of the testimony in front of us if you would like to proceed and summarize your testimony. Mr. Tousley, we will start with you speaking on behalf of the Yakima Indian Nation.

STATEMENT OF DEAN R. TOUSLEY, ON BEHALF OF THE YAKIMA INDIAN NATION, TRIBAL COUNCIL CHAIRMAN, MELVIN R. SAMPSON

Mr. TOUSLEY. Thank you, Mr. Chairman. My name is Dean Tousley. I am the attorney for the Yakima Indian Nation Nuclear Waste Program. On behalf of the Yakima Tribal Chairman, Melvin Sampson, and the Yakima nuclear waste program manager, Russell Jim, I wish to thank the committee for once again soliciting the tribe's views on proposed reforms in the nuclear waste program. They have also asked me to convey to you their apologies for their inability to personally attend the hearing today.

Before us today are a number of bills which attempt to address various aspects of the present malaise in the nuclear waste program. Some of the ideas these measures embody, as well as the ideas embodied in other bills that have been proposed, such as S. 839, might very well contribute to the ultimate solutions to this program's problems. The concepts of longer term storage of spent fuel, reprocessing, subseabed disposal, broader participation rights, and financial incentives for host states and tribes could all ultimately prove to be important ingredients in a comprehensive solution. However, we feel it would be premature for Congress to enact any of these proposed solutions at this time.

It has now been over 13 months since the Department of Energy announced the decisions that precipitated the program's present crisis. During that time literally dozens of bills have been introduced on the subject. Most of them, like the bills under consideration today, would prescribe various solutions to the program's problems.

Unfortunately, none of the solution-prescriptive proposals has gained broad support either in Congress or among the affected parties. Many of them lack support because they are patently parochial in their approach, such as those that would simply conclusively kill the second repository provisions of the act.

Others, although not parochial in nature, lack support because they would insist upon proceeding on the basis of DOE's process and results to date which are altogether lacking in credibility.

Finally, some lack support because they would represent a wholesale rejection of the major premise of the Nuclear Waste Policy Act—namely, that final disposal in a deep geologic repository should be the major emphasis of the program—and the technical and policy groundwork for such a sweeping change has not yet been adequately laid.

It is quite clear that Congress must ultimately act to restore credibility to this program. However, we are now convinced that a systematic reassessment of the entire program is necessary before Congress acts.

Moreover, experience during the past 13 months indicates Congress is probably not the proper forum to undertake the reassessment or to initially formulate the necessary solutions. Continued piecemeal considerations of dozens of uncoordinated and often conflicting proposals, none of which enjoys broad support, does not show much promise of yielding the desired results.

Accordingly, the Yakima Indian Nation supports the recently introduced proposals in both the House and the Senate to implement a temporary moratorium on site-specific program activities while an independent review commission appointed by the leaders of Congress undertakes the comprehensive review which the program now clearly requires. Such a commission could devote itself full time to these issues, a luxury which this committee and Congress as a whole do not have, but which appears to be quite necessary under the circumstances.

After such a commission has completed its comprehensive review of the program in close consultation with all affected parties and reported to Congress its findings and recommendations, Congress will have an adequate basis for deciding how best to revitalize the nuclear waste program.

In conclusion, the Yakima Indian Nation commends the drafters of these bills for acknowledging the inability of this program to proceed on its present course and for working toward solutions. However, until comprehensive and systematic consideration of the program's problems and the many proposed solutions has been completed, we feel that enactment of the solution-prescriptive bills would be premature.

An adequate technical and policy basis has not yet been established for making final decisions about how best to proceed with this program. The review commission proposals appear to offer the best mechanism for establishing that necessary basis. Moreover, it is already clear that these proposals enjoy broader support than do the solution-prescriptive bills.

Finally, I would like to say something about an issue which Senator Evans has questioned several witnesses about already this morning, and that is the proposed linkage between use of an MRS facility and the licensing of a repository.

We feel that you have done a very good job of pointing out one obvious problem with that proposed linkage, and that is that it holds the MRS hostage. We also would add to that consideration the fact that it holds the NRC's repository licensing decision hostage by bringing in a totally extraneous consideration of whether—that MRS facilities in fact completed and ready to accept waste. And to have that pressure on the commission, when they are trying to decide whether or not to license a repository, is totally inappropriate we feel. The commission has come out against it. Whether or not it would, in fact, unduly influence the commission, the appearance of it is sufficiently problematic that we feel the proposal should be rejected on that basis.

Thank you very much.

[The prepared statement of Mr. Tousley follows:]

Statement of
Dean R. Tousley
on behalf of
Yakima Indian Nation
Tribal Council Chairman
Melvin R. Sampson

before the

UNITED STATES SENATE
COMMITTEE ON ENERGY AND NATURAL RESOURCES

concerning
Proposed Legislation Related to
the Federal High-level Radioactive Waste Disposal Program

July 16, 1987

Mr. Chairman, members of the Committee--

My name is Dean R. Tousley. I am an attorney for the Yakima Indian Nation Nuclear Waste Program. On behalf of Yakima Tribal Council Chairman Melvin Sampson, and Yakima Nuclear Waste Program Manager Russell Jim, I wish to thank the Committee for once again soliciting the Yakima Nation's views on proposed reforms in the nuclear waste program. They have also asked me to convey to you their apologies for their inability to personally attend the hearing today.

Before us today are a number of bills which attempt to address various aspects of the present malaise in the nuclear waste program. S. 1266, sponsored by Sen. Evans, would shift from the NWPA focus on early disposal of spent fuel in repositories to an emphasis on temporary storage in regional MRS facilities. S. 1141, introduced by Sen. Hecht, would also shift to an emphasis on longer-term storage of spent fuel at reactor sites or MRS facilities. S. 1211, introduced by Sen. Hecht, would mandate suspension of site-specific work on geologic disposal pending a study of the feasibility of spent fuel reprocessing by the National Academy of Science. S. 1428, also introduced by Sen. Hecht, would mandate increased emphasis on research concerning sub-seabed disposal. Finally, S. 1007, introduced by Sen. Hatfield, would broaden the rights of participation in the program to states that share potentially affected surface waters or aquifers with the host state.

Some of the ideas these measures embody, as well as the ideas embodied in other proposed bills, such as S. 839, might contribute to the ultimate solutions to this program's problems. The concepts of longer-term storage of spent fuel, reprocessing, subseabed disposal, broader participation rights, and financial incentives for host states and tribes, could all ultimately prove to be important ingredients in a comprehensive solution. However, we feel it would be premature for Congress to enact any of these proposed solutions at this time.

It has now been over thirteen months since the Department of Energy announced the decisions that precipitated the program's present crisis. During that time, literally dozens of bills have been introduced on this subject. Most of them, like the bills under consideration today, would prescribe various solutions to the program's problems.

None of the solution-prescriptive proposals has gained broad support, either in Congress, or among the affected parties. Many of them lack support because they are patently parochial in their approach, such as those that would conclusively kill the second repository provisions. Others, although not parochial in nature, lack support because they would insist upon proceeding on the basis of DOE's process and results to date, which are altogether lacking in credibility. Finally, some lack support because they would represent a wholesale rejection of the major premise of the Nuclear Waste Policy Act (namely, that final disposal in geologic repositories should be the major emphasis of the program), and the technical and policy groundwork for such a sweeping change has not yet been adequately laid.

It is quite clear that Congress must ultimately act to restore credibility to this program. However, we are now convinced that a systematic reassessment of the entire program is necessary before Congress acts. Moreover, experience during the past thirteen months indicates Congress is probably not the proper forum to undertake the reassessment or to initially formulate the necessary solutions. Continued piecemeal consideration of dozens of uncoordinated and often conflicting proposals, none of which enjoys broad support, does not show much promise of yielding the desired results.

Accordingly, the Yakima Indian Nation supports the recently introduced proposals in both the House and the Senate to implement a temporary moratorium on site specific program activities while an independent review commission appointed by the leaders of Congress undertakes the comprehensive review which the program now clearly requires. Such a commission could devote itself full-time to these issues, a luxury which this Committee and Congress as a whole do not have, but which appears to be quite necessary under the circumstances. After such a commission has completed its comprehensive review of the program, in close consultation with all affected parties, and reported to Congress its findings and recommendations, Congress will have an adequate basis for deciding how best to revitalize the nuclear waste program.

In conclusion, the Yakima Indian Nation commends the drafters of these bills for acknowledging the inability of this program to proceed on its present course, and for working toward solutions. However, until comprehensive and systematic consideration of the program's problems and the many proposed solutions has been completed, we feel that enactment of the solution-prescriptive bills would be premature. An adequate technical and policy basis has not yet been established for making final decisions about how best to proceed with this program. The review commission proposals appear to offer the best mechanism for establishing that necessary basis. Moreover, it is already clear that those proposals enjoy broader support than do the solution-prescriptive bills.

Senator EVANS. Thank you. I thank you particularly for the final commentary which I had not thought of.

Mr. Del White, Chairman, of the Nez Perce Executive Committee.

STATEMENT OF DEL T. WHITE, CHAIRMAN, NUCLEAR WASTE SUBCOMMITTEE, NEZ PERCE TRIBAL EXECUTIVE COMMITTEE

Mr. WHITE. Thank you, Mr. Chairman. I would like to just make for the record a notation that for the introduction of myself that I do not mind being called the Chairman, but I am not the Chairman of the tribe. I am the Chairman of our Nuclear Waste Subcommittee. I do not mind the upgrade, but I think my Chairman would.

Senator EVANS. All right. Chairman of the Nuclear Waste Subcommittee.

Mr. WHITE. I am on the governing body. I serve as assistant secretary-treasurer of the tribe.

Senator EVANS. Thank you.

Mr. WHITE. Mr. Chairman, I would again like to say that—members of the committee, I am Del White, member of the Tribal Executive Committee, which is called NPTEC, which is the governing body of our tribe. And again, I would like to say that I also serve in that capacity as the Chairman of the Nuclear Waste Subcommittee.

We have submitted our prepared testimony for the record. And I would at this time like to summarize our views.

This is the fourth time in the last 3 months that we have traveled to Washington to present testimony before this committee, as well as other committees of the Congress and including the Nuclear Regulatory Commission. But be advised that I am not complaining. We appreciate the recognition of our tribal rights provided for in the Nuclear Waste Policy Act and the continued opportunity that you have provided to participate in the political process.

I do, however, think that the frequency of hearings, the over 20 proposed bills, and approximately 30 lawsuits reflect the major frustration over the implementation of the Nuclear Waste Policy Act. Senator Evans, in your finding in Senate 1266, in terms of status as "The present situation of the nuclear waste program is in serious disarray," and also Congressman Udall, long a strong advocate of the Nuclear Waste Policy Act programs set upon introducing H.R. 2888 that—and I quote again—"The program is now in limbo."

Everyone agrees on what has caused their problems with the nuclear waste program. For our part we have testified that we believe that the Department of Energy has implemented the act in a biased manner.

We also realize that because we are a party of interest our views, as well as the views of other affected tribes and states, are not universally accepted.

Others have asserted the problems are primary political, a problem of public perceptions compounded by the inability of any state or tribal official to accept the selection of their area for a repository or a monitored retrievable storage facility.

We note for the record that the Nez Perce tribe has publicly committed not to utilize our statutory right to disapprove the Hanford site based upon the premise that if we can be convinced that the repository is safe, and that now a reasonable scenario exists under which dangerous levels of radioactivity will be released from the repository.

In any event, we feel at this point that the efforts should be to ascertain the facts in the quickest, most impartial manner available, and then proceed to implement the Nuclear Waste Policy Act with whatever modifications are necessary.

We were pleased when Congressman Udall recently introduced H.R. 2888 which placed a moratorium on site-specific activities while providing for a timely review of issues that we and others have defined as critically important, particularly including the adequacy of site selection guidelines, the methodology used to rank candidate sites, the recommendations based on such a methodology, and whether the Department of Energy should continue to have responsibility for the Nuclear Waste Policy Act.

While the approach of H.R. 2888 closely accords with our views, it is not, as Congressman Udall has made clear, a final product. We believe that any moratorium should contain an automatic restart provision that mandates a nationwide search for a repository site. Any moratorium should also continue financial support to affected tribes and states to insure continued and effective participation.

We believe the issues addressed in the three bills before the committee relative to different aspects of an expanded MRS role in their nuclear waste program should be addressed in the independent review contemplated in H.R. 2888. We are, however, not inclined to support proposals that substitute MRS systems for a permanent repository.

We believe that a permanent solution for nuclear waste is required, a solution that does not depend on each new generation affirming the commitments of the previous generations. We as Indian tribes can uniquely verify the problems in relying upon the commitments of earlier generations.

Senate bill 1266 is a particularly intriguing legislative proposal and may well contain many of the elements that need to be ultimately adopted in the amendments to the Nuclear Waste Policy Act automatic restart, revisit nationwide site selection, and regional fairness.

Senate bill 1266 removes much of the geologic siting responsibility from the Department of Energy and transfers it to the Department of the Interior. This is a significant change that should be carefully reviewed. Perhaps energy should be removed from the process completely, or perhaps another entity other than the Interior should be utilized or something new be set up.

These questions could be objectively addressed in the review process contemplated during the recommended moratorium. We support the general thrust of Senator Hatfield's Senate bill 1007 with reservations as noted in our prepared testimony to extend their participation rights.

Chairman, this concludes my oral statement, and again I thank you for the opportunity to appear and present the views of the Nez Perce tribe.

[The prepared statement of Mr. White follows:]

TESTIMONY OF DEL T. WHITE
NEZ PERCE TRIBAL EXECUTIVE COMMITTEE
BEFORE
THE UNITED STATES SENATE COMMITTEE
ON
ENERGY AND NATURAL RESOURCES

JULY 16, 1987

Mr. Chairman, members of the Committee, I am Del T. White, a member of the Nez Perce Tribal Executive Committee, NPTEC, and Chairman of the Nuclear Waste Subcommittee of NPTEC and I am accompanied by Ronald T. Halfmoon, the Manager of the Tribe's Nuclear Waste Policy Act Program.

I wish to thank the Chairman and the members of the Committee for the opportunity to appear and testify at this hearing on proposed amendments to the Nuclear Waste Policy Act of 1982.

The Nez Perce Tribe was certified in 1984 by the Secretary of the Interior as an affected Tribe for purposes of the Nuclear Waste Policy Act of 1982 (NWPA). At that time it was determined that the Nez Perce Tribe could suffer significant and adverse impacts to our off-reservation treaty rights should the Hanford, Washington site be selected as a repository for nuclear wastes. Since that time, of course, Hanford has in fact selected as one of the three sites for characterization for the first geological nuclear waste repository.

This is the fourth time in the last three months that we have traveled to Washington to present our views on the implementation of the Nuclear Waste Policy Act. The frequency of our appearance itself is a minor piece of evidence in the web of frustration and failure that has characterized the implementation of the Nuclear Waste Policy Act.

Public confidence in the Department of Energy's implementation has been seriously eroded. Litigation abounds. Congress has refused to fund aspects of the NWPA program this fiscal year and such funding may again be withheld in the upcoming fiscal year. The second repository program seems to be on the verge of total shutdown. DOE's consultation with States and Tribes, although somewhat improved from the Nez Perce perceptive, has been severely criticized.

In this Congress, over twenty bills have been introduced; these bills for the most part are not technical or minor program amendments, but represent direct attempts to change one or more major aspects of the Nuclear Waste Policy Act. Today, four of these bills are before this Committee for hearing. Previously your Committee held hearings on S. 839 introduced by Chairman

Johnston and our State's senior Senator, the ranking minority member, Senator McClure.

To date, our Tribe has not endorsed a specific legislative proposal. We have, however, determined the factors that we feel should be encompassed in efforts to cure the failure of implementation.

*Nuclear waste requires a sound solution now and for the future

*Conceptually NWPA is sound legislation

*DOE's implementation of NWPA has been so seriously flawed that a mid-course correction is required.

*An appropriate mid-course correction would include:
  -a freeze on drilling and all site specific work;
  -a scientific review of DOE's performance by an independent Commission;
  -continued financial support to States and affected Tribes to assure continued and effective participation;
  -exploration of the concept that site characterization identify and resolve on a priority basis those factors that could disqualify a site;
  -exploration of a possible expanded role for the Nuclear Regulatory Agency, or other entities, to assure impartiality; and
  -automatic resumption of the NWPA process upon completion of the Commission review, with the requirement of a national-wide search for repository sites.

A great deal of the direction that one takes at this stage is determined by how the problem that is to be cured is defined. In our perception, the problem that needs correction is DOE failure to properly implement the NWPA. Because so much of the criticism of DOE has come from the States and the affected Indian Tribes -- paradoxically both the obvious parties of interest and the only parties close enough to the situation to be able to fully critique DOE -- our view that the problem that needs curing is DOE has not found universal acceptance. Others assert that the problem with the NWPA is primarily a political one -- a problem of public perceptions compounded by the inability of any State, Tribal, or local elected officials to accept the selection of their area for a Repository or MRS.

If our perception is right, and we believe it is, DOE's flawed implementation, uncorrected could doom the future of the NWPA. A DOE that cannot apolitically determine site selection for a repository cannot apolitically select either one or three sites for an MRS. A DOE that seems inexorably precommitted to parcels of land that it controls and has worked with, cannot be expected to implement either the Repository program or a MRS program in a fair and impartial way.

The only apparent agreement is that there is a problem. Although we have previously testified before Committee and responded to follow-up questions from the Committee regarding the facts that support our perception of DOE as the problem, as noted above we realize that there are other viewpoints. We believe at this point, that the effort should be to ascertain the facts in the quickest, most impartial manner available, and then proceed expeditiously to implement the NWPA, with whatever modification are necessary.

The Nez Perce Tribe, therefore, was pleased when the Chairman of Interior and Insular Affairs Committee in the House of Representatives, Mo Udall, along with some fifty members of the House, introduced H.R. 2888 a short while ago. To date, this approach most closely accords with our own perception. It places a moratorium on site specific activities, while providing for a timely review of the issues that we and others have defined as critically important -- particularly including: the adequacy of the site selection guidelines; the methodology used to rank candidate sites; the recommendations based on such methodology; and whether DOE should continue to have responsibility for the NWPA.

Congressman Udall has indicated that H.R. 2888 is a beginning and not a final legislative product. This is important, for as drafted it does not contain an automatic restart provision. We believe such a provision is critical to actually assuring that safe and permanent storage of nuclear waste will occur. The hearing and mark-up process contemplated for H.R. 2888 will allow these and other issues to be fully addressed.

We are aware that although no Senate companion bill to H.R. 2888 exists, that Amendment No. 428 has been filed in the Senate on July 1, 1987. It is similar in important aspects to H.R. 2888 in that it places a moratorium on site specific activities and provides a study of critically important issues. There are, however, major differences. Senate amendment No. 428 provides for 13 member Commission, while H.R. 2888 creates a 3 member Congressional Commission. Amendment No. 428 also creates an incentive system regulated by the NRC of "interim" storage by licensees of spent fuel. These and other issues, particularly automatic restart requirements, in the moratorium approach require full Congressional review and probable modification. Although we are favorably disposed to many of the provisions in Senate Amendment No. 428, we can not at this time support it.

MRS Proposals

Before commenting on the specific legislative proposals involving Monitored Retrievable Storage facilities (MRS), it is necessary to comment concerning proposals that make MRS facilities the permanent solution to the NWPA problems. First off, we are aware that Congress addressed the issue of utilizing MRS facilities as the permanent solution for the storage of spent nuclear fuel and determined that it did not want to rely for a thousand years on a system that depended on the commitment and diligence of yet unborn generations. It is not necessary to produce a parade of horribles to demonstrate the difficulty in the long term reliance on the commitments made by earlier generations. Indian tribes, are in a unique, albeit unenviable position, to verify the good judgement of Congress in choosing a permanent storage solution for nuclear waste that is not dependent on future generations. Many of our treaties with the United States stem from the mid-nineteenth century. As the volumes of testimony and decisions of the Court of Claims and the Indian Claims Commission can attest, broken commitments are far too common.

A different analysis of course is pertinent to proposals that utilize MRS facilities as a part of the NWPA process that ends in a permanent Repository. Proposals which contemplate expanded MRS facilities and time-frames seem to have some attraction. It is asserted that such systems could provide positive benefits such as, reduced transportation, safer spent/consolidated fuel for ultimate Repository shipment, and the ability over a longer period of time to have the option to reuse spent fuel should technology so allow. Others have argued that transportation risks will be greater, and concern has been expressed that spent fuel should not become a reusable commercial commodity because of the military uses that should spent fuel might ultimately be put to by other countries.

We believe that these and other questions pertaining to an expanded MRS system should be properly addressed by the independent Commission recommended in H.R. 2888.

The Specific Bills

S. 1007, This bill addresses an issue which is different from the focus of our testimony -- the participation of States adjacent to proposed repository sites. We agree with Senator Hatfield that "nuclear contamination has no regard for State or national borders." The Hanford site is not many miles from either Oregon or Idaho. We think that is appropriate that such adjacent States and Tribes, for that matter, have participation rights under the NWPA. We suggest participation under sections 116, 117, and 118,with the exception of the rights of disapproval, would be reasonable. We are not sure that rivers, waterways, or underground aquifers are the best mechanisms upon which to base participation rights. For example, there is some question as to where exactly the Ogallala Aquifer extends and how many states would be covered. Perhaps a geographic radius standard could achieve the desired result.

S.1141, provides that spent fuel must be stored for fifty years before being placed in a Repository. Storage can be at a nuclear power plant or a a MRS. Whether this a proper period for storage pre-repository is subject of dispute. DOE has testified before this Committee that little is gained over such a long period in terms of cooling and has recommended a much shorter period to Congress in its MRS proposal. DOE could well be wrong; its credibility on all NWPA issues is at this point at least suspect. We recommend that the independent Commission contemplated by H.R. 2888 is the place to address this question.

S.1211, contemplates a freeze on site specific work under NWPA, while a study is conducted by the National Academy of Sciences, under contract from DOE, to study the feasibility of reprocessing spent nuclear fuel. Site Specific work is automatically restarted after submission of the contemplated report. As noted earlier, the questions that Senator Hecht wishes to have addressed are legitimate questions. Our concern is that they be addressed as part of a total review of the many legitimate questions that now exist. A process that more fully defines the freeze, and provides a mechanism that can hold hearings, issue subpoenas, and compel cooperation seems to us to be a preferable approach.

We have serious reservations about using a contracting relationship with DOE to evaluate a process that DOE has a clear position concerning.

S.1266, suspends the NWPA until 1998 for essentially any activities related to the Geological repository. In the interim DOE is authorized to construct at least three Regional MRS facilities, one in each of three of four identified regions. The Department of the Interior is given responsibility to conduct a nationwide study to identify potentially usable Repository sites. Nine sites in at least three geologic media are to be selected. Cooperation and Consultation agreements are then to be negotiated by DOE with states and affected Tribes. Funding is also provided for incentives and a significant research effort related to alternatives for the disposal of high-level radioactive waste. This comprehensive proposal of Senator Evans has a good deal to commend it. It would revisit the entire issue of repository siting and remove DOE from much of the process. A position that is consistent with our criticism of DOE.

The Department of the Interior is the entity in S. 1266 that would conduct the siting process. As you are probably aware, Indian Tribes have had extensive experience with the Department of the Interior and we are not sure that Interior would be the objective decision-maker desired. In fact, we do not at this point know what entity to recommend to take DOE's place, or even whether, as tempting as it may be, DOE need in fact be so completely removed from the siting process. It is because of questions of this nature, that we would prefer to see an outside objective entity such as the Commission contemplated by H.R. 2888 provide Congress with detailed and comprehensive advice. Congress after receipt of such a report could at that time determine whether to change courses, and if necessary address what direction a major over-haul should take.

Senator HECHT. Thank you very much.

Mr. Bill Burke.

STATEMENT OF BILL BURKE, DIRECTOR, NUCLEAR WASTE STUDY PROGRAM, CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

Mr. BURKE. Thank you, Mr. Chairman.

My name is Bill Burke. I am the Director of the Umatilla Nuclear Waste Study Program. It is a pleasure to have this opportunity to appear before this committee again to provide the perspectives of the Umatilla Tribe on resolving the stalemate of the high-level nuclear waste program. The tribe is grateful for the efforts of Senators Hatfield and Evans in responding to the particular problems we face in the Northwest as a result of DOE's flawed implementation of its responsibilities under the Nuclear Waste Policy Act. We know our interests and concerns will be well-represented because of your presence on this important committee.

Before commenting on the bills introduced by Senators Hatfield and Evans, S. 1007 and S. 1266, I would like to restate the underlying position of the Umatilla Tribe on this issue.

We continue to support the principles and objectives of the Nuclear Waste Policy Act as it was enacted in 1982. The repository program has failed because of DOE's unwillingness or inability to implement a program consistent with the letter and spirit of the Nuclear Waste Policy Act. The four years the Umatilla Tribe has been involved in the repository program has led us to the conclusion the failure of the program is not due to deficiencies in the act, but rather to deficiencies in its implementation.

Let me now speak to two of the bills before this committee. S. 1007 would extend affected status to all states sharing a surface or subsurface water body with a host state. My initial response to the bill is that it needs to be amended to permit tribes sharing water courses with host states or tribes to receive affected status under the Nuclear Waste Policy Act. As you know, tribes have reserved water rights to surface and subsurface waters to fulfill the purposes for which their reservations were created. So, tribes like states have a tremendous interest in the impact a repository would have on the source of their domestic water supply or on rivers and streams where they exercise fishing rights reserved in their treaties with the United States Government.

I suspect that Senator Hatfield's intent in introducing S. 1007 was to insure that the State of Oregon's interests were heard and addressed by DOE since the Hanford site sits near the Columbia River.

The Umatilla Tribe strongly supports the right of Oregon to participate in the repository program. We have worked closely with Oregon's Department of Energy on Hanford issues and look forward to continuing to do so.

We also work cooperatively with other Oregon state agencies to regulate and enhance the anadromous fisheries of the Columbia which is so important to the culture and economy of the Tribe.

Nonetheless, we have some concerns about extending all the rights of sections 116 and 118 to all states and tribes sharing water courses with a host government. That could lead to repository sites with dozens of states and tribes with affected status which would be unworkable.

However, we would support nuclear waste fund grants to these governments so that they could monitor repository activities that could impact the shared water course. It may be more efficient to provide funding to organizations that represent several of the states or tribes to oversee DOE activities. This is currently being done on a limited basis in the area of transportation in the repository program.

The Umatilla Tribe also finds much to commend in S. 1266 introduced by Senators Evans and Hecht. We support the bill's requirement that the beneficiaries of nuclear power should bear the burden of disposing of nuclear waste, that more time is needed to find the best repository site based on a thorough technical analysis with scientific credibility and that greater compensation should be provided the host government after the best site has been located.

The bill also needs to strengthen the role of affected tribes consistent with their sovereign authority and their status under the NWPA. The Umatilla Tribe is particularly concerned about Hanford being selected as an MRS site, a likely result given the bill's preference for Federal sites and for sites close to the source of high-level wastes to reduce transportation risks.

In that Hanford is located next to the Columbia River on the aboriginal lands of the Umatillas, we feel we should be involved in all aspects of the siting, planning, construction, and operation of any MRS facility at Hanford. Therefore, section 150(a) of the bill needs to be clarified to insure non-host affected Indian tribes are entitled to impact assistance.

Section 150(b) should also be changed to provide that a portion of the long-term rental benefits be paid to Indian tribes impacted by an MRS facility.

Finally, the bill's amendments to the Hazardous Materials Transportation Act should also permit tribes to exercise the same regulatory authority as states on the transportation of nuclear wastes. The transportation is a vital interest to us as the major highway and railroad routes to the east and south of Hanford pass through the center of our reservation.

The Umatilla Tribe has determined that the most effective way to resurrect the repository program consistent with the original intent of the NWPA is to support the moratorium bills introduced by Congressman Udall and Senator Sasser. While we have problems with certain aspects of each of these bills, we feel the repository program needs to be brought to a temporary halt while the implementation of that program is closely scrutinized by a commission of experts. The experience of similar commissions in reviewing the Social Security system and the Iranian arms sales and suggesting solutions to the problems they identified suggest this approach would be successful in assisting Congress in putting the repository program back on track.

I would also point out that both the proposals before the committee today would be within the purview of the commission's investigation. However, as I have previously stated, we think the NWPA framework should not be abandoned until it has been proven defective. We do not think that this is the case.

With DOE's plans to release their site characterization plans in the near future and begin characterization of the sites in earnest, it is time to correct problems in the repository program now.

As I have told this committee in prior testimony, the Umatilla Tribe is prepared to work with you in this effort. Again, I thank the committee for the opportunity to testify today.

[The prepared statement of Mr. Burke follows:]

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION TESTIMONY BEFORE THE SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

July 16, 1987

Mr. Chairman, my name is Bill Burke. I am the Director of the Umatilla Nuclear Waste Study Program. It is a pleasure to have this opportunity to appear before this Committee again to provide the perspectives of the Umatilla Tribe on resolving the stalemate in the high-level nuclear waste program. The Tribe is grateful for the efforts of Senators Hatfield and Evans in responding to the particular problems we face in the Northwest as a result of DOE's flawed implementation of its responsibilities under the Nuclear Waste Policy Act. We know our interests and concerns will be well represented because of your presence on this important Committee.

Before commenting on S. 1007 and S. 1266, I would like to restate the underlying position of the Umatilla Tribe on this issue. We continue to support the principles and objectives of the Nuclear Waste Policy Act as it was enacted in 1982. The repository program has failed because of DOE's unwillingness or inability to implement a program consistent with the letter and spirit of the Nuclear Waste Policy Act. The repository program is stagnant and has lost public confidence because:

1) siting decisions have been based largely on political and programmatic factors, not technical merit;

2) technical evaluations by DOE have failed to include an adequate level of conservatism; and

3) states and affected tribes have been denied the

opportunity to participate in the program as Congress intended. The fours years the Umatilla Tribe has been involved in the repository program has led us to the conclusion the failure of the program is not due to deficiencies in the Act, but rather to deficiencies in its implementation.

Let me now speak to two of the bills before this Committee. S. 1007 would extend affected status to all states sharing a surface or subsurface water body with a host state. My initial response to the bill is that it needs to be amended to permit tribes sharing water courses with host states or tribes to receive affected status under the NWPA. As you know, tribes have reserved water rights to surface and subsurface waters to fulfill the purposes for which their reservations were created. So tribes, like states, have a tremendous interest in the impact a repository would have on the source of their domestic water supply or on rivers and streams where they exercise fishing rights reserved in their treaties with the U.S. Government.

I suspect that Senator Hatfield's intent in introducing S. 1007 was to insure that the State of Oregon's interests were heard and addressed by DOE since the Hanford site sits near the Columbia River. The Umatilla Tribe strongly supports the right of Oregon to participate in the repository program. We have worked closely with Oregon's Department of Energy on Hanford issues and look forward to continuing to do so. We also work cooperatively with other Oregon state agencies to regulate and enhance the anadromous fishery of the Columbia which is so important to the culture and economy of our Tribe.

Nonetheless we have some concerns about extending all the rights of Sections 116 and 118 to all states and tribes sharing water courses with a host government. That could lead to repository sites with dozens of states and tribes with affected status which would be unworkable. However, we would support Nuclear Waste Fund grants to these governments so they could monitor repository activities that could impact the shared water course. It may be more efficient to provide funding to organizations that represent several of the states or tribes to oversee DOE activities. This is currently being done on a limited basis in the area of transportation in the repository program.

The Umatilla Tribe also finds much to commend in S. 1266 introduced by Senator Evans. We support the bill's requirement that the beneficiaries of nuclear power should bear the burden of disposing nuclear waste, that more time is needed to find the best repository site based on a thorough technical analysis with scientific credibility and that greater compensation should be provided the host government after the best site has been located.

However, we have some concerns about elevating the MRS concept over the deep geologic disposal of high level wastes. Given the time schedules in the bill, the regional MRS facilities would be completed before the repository site was fully characterized and well before licensing and construction. We fear a repository would fare poorly in Congress under those circumstances.

The bill also needs to stregthen the role of affected tribes consistent with their sovereign authority and their status under the NWPA. The Umatilla Tribe is particularly concerned about Hanford being selected as a MRS site - a likely result given the bill's preference for federal sites and for sites close to the sources of high level wastes to reduce transportation risks. In that Hanford is located next to the Columbia River and on the aboriginal lands of the Umatillas, we feel we should be involved in all aspects of the siting, planning, construction and operation of any MRS facility at Hanford. Therefore, Section 150 (a) of the bill needs to be clarified to insure non-host affected Indian tribes are entitled to impact assistance. Section 150(b) should also be changed to provide that a portion of the "long term rental benefits" be paid to Indian tribes impacted by a MRS facility. Finally, the bill's amendments to the Hazardous Materials Transportation Act should also permit tribes to exercise the same regulatory authority as states on the transportation of nuclear wastes. The transportation issue is a vital interest to us as the major highway and railroad routes to the east and south of Hanford pass through the center of our reservation.

The Umatilla Tribe has determined that the most effective way to resurrect the repository program consistent with the original intent of the NWPA is to support the moratorium bills introduced by Congressman Udall and Senator Sasser. While we have problems with certain aspects of each of these bills, we feel the repository program needs to be brought to a temporary halt while the implementation of that program is closely scrutinized by a commission of experts. The experience of similar commissions in reviewing the social security system and the Iranian arms sales and suggesting solutions to the problems they identified suggest this approach would be successful in assisting Congress in putting the repository program back on track. I would also point out that both the proposals before the Committee today would be within the purview of the commission's investigation. However, as I have previously stated, we think the NWPA framework should not be abandoned until it has been proven defective. We do not think that this is the case.

With DOE's plans to release their Site Characterization Plans in the near future and begin characterization of the sites in earnest, it is time to correct problems in the repository program now. As I have told this Committee in prior testimony, the Umatilla Tribe is prepared to work with you in this effort. Again, I thank the Committee for the opportunity to testify today and I am willing to answer any questions you may have.

Senator HECHT. Thank all of you very much.

Senator Evans has had to leave the hearing to attend another commitment. He did ask me, however, to submit questions to you for the record. And the hearing record will be open until the close of business on Friday.

Thank you very much.

Our next witness is Professor Todorovich. Would you please come up? Thank you for coming down from New York to testify.

I will be going through these different bills which I want to hear your viewpoints on, but if you have an opening statement—did you bring an opening statement with you?

Dr. TODOROVICH. Yes, sir.

Senator HECHT. Would you like to make it?

Dr. TODOROVICH. I would appreciate if I would be given the opportunity.

Senator HECHT. You make your opening statement, and then we will go over the different legislation please.

STATEMENT OF DR. MIRO M. TODOROVICH, EXECUTIVE DIRECTOR, SCIENTISTS AND ENGINEERS FOR SECURE ENERGY

Dr. TODOROVICH. Mr. Chairman, ladies and gentlemen, it is a pleasure for me to be able to appear before this committee and testify on behalf of the Scientists and Engineers for Secure Energy, a public interest group of over 1500 professional scientists and technologists nationwide covering all the relevant branches science and technology involved in creating an understanding of the matter at hand.

The members of our group share the philosophy that prudent uses of technology are essential to the maintenance and amelioration of the quality of human life, and they are also committed to providing information and analysis to decisionmakers like you and the public which has to respond to the suggestions.

In furtherance of these purposes, SE2 conducted in 1979 an international inquiry on nuclear waste disposal which was part of a 4-day conference held at Stanford University. We have also participated as amici curiae in the City of New York, the case of the City versus United States Department on Transportation. I am mentioning this only to underscore our long-term commitment and interest in the matter. I am a professor of physics at City University of New York and have been the Executive Director of SE2 since 1977.

Now, if I may just notice that these hearings started with the appearance of some legislatures and people from the side of the executive branch, and there were cameras around, and the room was filled to capacity, which is natural, of course, because those who make decisions are quite in the eye of the public and of the media. As some of these officials left, so did the cameras, and so did I think a lot of people in the public, many of them probably from the written and radio groups.

I know also at this time it is about lunchtime and people have added inducement to take care of some natural needs.

But I think there is also another aspect which I want just to mention, and this is that actually when we talk about the scientific side of the problem—and that is what I am really in many respects competent to do—there is an underlying understanding in the air everywhere that actually these things must be known because after all they are implemented elsewhere successfully. There are reprocessing things going on. There are intermediate disposal repositories elsewhere. The Japanese are sending these things all over the oceans to France to be done.

It is not really truly a scientific problem. It is much more a political problem of how, as I heard Mr. Rusche—my friend Rusche talking—how to adjust the behavior of the government officials and to a certain extent of Congress to the various perceptional pressures, of course taking into account certain facts on the scientific side, but being much more influenced with the difficulty of satisfying too many constituencies which are putting the pressure over these many years that we have confronted the problem.

I could only say that, therefore, the reaction of those who are translating what is going on here into the understanding of the public is obviously focused there where the power is, where the decisions are made. And if what I heard from Senator Evans and you is, indeed, true that there is in Congress an interest to try to put aside the past and try to say if we would now start building the thing again together, what should be the basic building blocks to put into the foundation of such a new building.

If this is, indeed, a kind of a new approach attempted and if this new approach will begin to make certain even limited decision visibly on the basis of what the scientific community and the experience elsewhere in the world is suggesting, then I think that the camera will begin to stay and begin to listen also what a physics professor, a secretary of a scientific organization, would like to suggest because perhaps his suggestions will appear embedded in some of the next legislation.

So with this little remark which is extemporaneous but very sincerely reflecting what I have seen during the last two hours here, let me go back to my prepared remark, if I may, Mr. Chairman.

Senator EVANS. Thank you, Professor. But I will say that your remarks will be in the record, and they will be read by the staff and all the Senators. I won't say that the Senators will all read them, but the staff will read them, and it will be taken to heart.

Dr. TODOROVICH. Thank you very much, Mr. Chairman. Let me continue now if I may.

I appreciate the opportunity to testify on various, mainly scientific and technical aspects embedded in the above-mentioned bills being considered by this Senate committee. Since some of the language in these bills overlaps, permit me to present my comments organized around a sequence of interrelated subjects.

The first topic I wish to address revolves around what S. 1266 appropriately characterizes as "a serious disarray" of the current Federal nuclear program which "requires a substantial mid-course correction." We find to start with a proposal for a two year study of the feasibility and appropriateness of nuclear waste reprocessing which in this country, as you may recall, was once pursued to the point where we had designed and built an appropriate reprocessing plant at Barnwell, North Carolina. It was an important recycling link in a planned, comprehensive and rational nuclear fuel management scheme of the kind which is now, for example, in full operation in France.

In 1977, however, all non-military reprocessing in the United States was stopped not because of any safety or economic concerns and not because someone had doubts about the feasibility of reprocessing, but rather because the then President Jimmy Carter entertained the concern that if the United States pursued reprocessing, which was almost at hand—and was to a limited extent actually done earlier at West Valley, New York—other perhaps less responsible countries would follow suit thus increasing the danger of nuclear weapons proliferation. "Reprocessing can lead to greater availability of weapons-grade nuclear fuels," so went the reasoning of Mr. Carter and his advisors, "and thus the United States should, at least for the time being, voluntarily renounce, despite its completed plant, the reprocessing route."

At that same time President Carter acted to convene and international inquiry, the International Nuclear Fuel Cycle Evaluation, known under the acronym of INFCE, with the stipulation, A, that the international group, which by the end of its term had delegates representing 56 countries of this world, report to him and the member nations in two years, and that the President of the United States will take the conclusions of the INFCE proceedings into account when deciding after the two year interlude on the future costs of spent fuel reprocessing in the United States.

The INFCE group prepared its draft report and statement of conclusion on time, which I was told failed to gain formal approval only because of the unwillingness of a single delegation, the United States, to go along.

Subsequently the U.S. moratorium on reprocessing continued in disregard of the unambiguous INFCE conclusion that spent nuclear fuel reprocessing can be conducted safely and with built-in safeguards against modalities which could lead to the increased nuclear weapons proliferation beyond what is already done by the nuclear club countries using installations designed to produce weapons-grade materials, and despite the earlier promise of our President to be guided by the INFCE findings. These findings were set aside.

In light of this past U.S. experience, which is worth recalling for the record, and of the fact that many countries worldwide which now enjoy the benefits of nuclear power are either reprocessing their spent nuclear fuel, preparing to do so, or contracting the job out to other countries with reprocessing plants, it seems clear that, one, the United States in 1977 apparently made a wrong turn on the nuclear fuel cycle issue. Two, the United States should promptly consider ways in which to remedy that error. Parenthetically SE2, our organization, is therefore fully supportive of a spent fuel reprocessing act. Three, the question is not whether nuclear reprocessing is feasible. It is done successfully in several countries. And four, reprocessing must be economical generally, or must have additional attractive features, otherwise it would not be practiced commercially elsewhere.

From all this, SE2 draws the logical conclusion that it will be most appropriate to entrust organizations like the American Association of Engineering Societies or some similar practical association or institute with the task of bringing together a working group of domestic and foreign technical and scientific experts to review the abundant existing knowledge and analyze foreign experience in the fuel reprocessing and recycling field, including their environmental effects, with a mandate to come up no later than December 15, 1988, with a set of practical, technical proposals for the U.S. spent fuel reprocessing.

Such a set of technical proposals, possibly involving several alternative engineering pathways, should be subsequently submitted for appropriate economic analysis to competent economic research organizations, for example, Resources for the Future, The Conference Board, or the Stanford Research Group.

By the way, I am not advocating any of these groups. I am just picking some examples of people who could on the basis of their experience and background do the job correctly and quickly and practically.

Such an analysis should take into account our regulatory, environmental, financial and labor practices as they affect the suggested engineering solutions and the foreign experience. The target date for such a report should be no later than June 15, 1989.

The proposed time schedules seems to us quite realistic. Let us recall that a few dozen experts directing the Manhattan Project needed less than half a decade to translate the result of a comparatively obscure scientific experiment in nuclear fission performed in 1939 into a fully developed technology suitable for peacetime as well as wartime purposes. They not only did a feasibility study during about five years, but also developed the blueprints and actually produced the necessary hardware and the finished products.

We at SE2 are quite convinced, given the current case of specific and specialized reprocessing technology and the extensive available pool of American Engineering and economic experts, that the much more modest study envisaged by the proposed bill can be accomplished in 18 months.

The second subject is closely related to the first. If the United States were to decide to first reprocess and then later dispose of the much smaller amount of residuals, for which at the time one could find no beneficial use, the whole waste disposal program could become altered by several orders of magnitude—in spatial volume and in time scale—and the previously mentioned mid-course correction of activities we believe would be in order.

Still, a correction need not mean suspension. While the volume of the radioactive materials may be drastically reduced, the residue will still require permanent disposal. The Swedes and others plan to do this underground in suitable, stable geologic formations. Consequently, site-specific work on potential geologic repositories, albeit it on an altered schedule, should in our judgment continue as a needed component in the overall planning for the handling of radioactive residues.

Let me at this point also note that the kind of concern raised by Mr. Rusche about the plutonium separation in the case of reprocessing is actually a positive aspect if one simply does what other countries do, take that plutonium as added fuel and burn it in a nuclear power plant, you get two things in one stroke. You produce more power from the fuel, and second, you simply remove plutonium from its position in our midst and therefore reduce the problem of handling that theory.

Senator **Hecht**. Excuse me, Professor. I do not like to interrupt you, but would you please expand on that because I feel this is such a key? Now, is it possible in your opinion to burn—recycle the plutonium and not make it necessary to put it into a deep level repository?

Dr. **Todorovich**. This is essentially done I know in France, I believe in Britain, I know in the Soviet Union except they may be using too much plutonium for other purposes, and they do not separate their civilian from the military one. But, yes.

And what is even more—and this has all been discussed in detail in the INFCE studies. The mixtures that can be prepared so that they will be used in civilian power producing reactors may and can be made in such a way that such fuel would not be reasonably usable for military purposes. In other words, if one wants plutonium for military purposes, he better have a dedicated plan, as countries of the club do have. And the plutonium from the civilian program can easily be used just as an added fuel in the production of commercial——

Senator **Hecht**. I just want to dwell on this because this is so important to get out to the public. Now, let's get back again. We can reburn this, to use the common expression. Then why has the Department of Energy—and not to criticize anyone, but this has not been taken into account. What they have wanted to do is—you heard part of Mr. Rusche's testimony—is take nuclear waste, not reprocess it and drop into the ground maybe after five years.

Dr. **Todorovich**. This is why I went a little bit through the history that this was not the course that this country was on not so long ago. We were then in concert of what other countries planned to do, and had we pursued that course, we would not have to even first discuss this matter.

And second, the public, reacting to what is indeed going on and which would be at that time like in France or elsewhere burning plutonium, would not have the concern.

You see that it was just a very unfortunate course of events that the then President on moral grounds than any other, trying to make us a model country which is willing not just to preach to others but also do to ourselves what we suggest to others, aborted the course on reprocessing. Of course, if you do not do reprocessing, you cannot extract what is still usable in the spent fuel. You have no other recourse than to either keep it on overground storage forever or go underground with it.

As I understand, we were trying to impose that not only on ourselves, but we were putting in our contracts when we were delivering fuel to other countries, that they have to return the spent fuel to this country, which caused other problems which I have just yesterday talked with some of my Swiss friends. Since they would like to burn up plutonium and so on, they do not want any more fuel from the United States which forbids that.

So, for a person like myself who has one foot in science and the other foot in interface between science and public policy for the last 15 years almost, I can only express my amazement how we have been able out of a simple pathway to create a very difficult knot which raises, as I say, all these questions in public mind which need not be there had we done the thing rationally and simply burnt out plutonium.

Senator **Hecht**. Does any other country not reprocess?

Dr. **Todorovich**. There are countries which are not themselves reprocessing, but then are using facilities of those who do have reprocessing.

Senator **Hecht**. Yes. I am sorry. I did not phrase that correctly.

Dr. **Todorovich**. And to my knowledge, I have no hard data here for every country. I do not know whether if they have only one or two reactors, it is worthwhile for them to go to the bother. But all bigger countries like Sweden, like Britain, like the Soviet Union, like Japan do reprocessing either themselves or under contract by others, and then get the purified material back for renewed use.

As a matter of fact, it is a very extensive international operation on many levels. For example, when not so long ago some barge with some spent materials was sunk in the English Channel and then retrieved, and it was quite a story on the evening and daily news and in the press, it turned out that this was material that the French were shipping to the Soviet Union where some of the processes are done by electricity and the electricity there was somehow for some reason cheaper. And so, it was sent there, like we sent our clothing to Singapore to be made—our textiles there to be made into clothing and returned, it seems a whole set of international operations is going on.

I am not an expert on that. I am just trying to give elements of that which are public knowledge and which are quite fascinating I think.

Senator **Hecht**. Please continue in your statement. Thank you.

Dr. **Todorovich**. The fourth subject concerns the monitored retrievable storage of radioactive materials. Oh, pardon me. I missed one, number three.

NWPA, the Nuclear Waste Disposal Act of 1982 stipulates that states which are candidates for sites participate in the site selection process. Neither our 1979 inquiry mentioned in the prologue nor later search have provided us with any peer reviewed scientific reason which would suggest a widening of this site selection process, the necessity for the widening of such site selection process; that is, that all states along a river or over an aquifer affected by the siting of a waste repository have cause to participate in the site selection process as provided by the current act. We thus advise against legislation which would stipulate such a widened requirement.

The fourth subject concerns the monitored retrievable storage, MRS, of radioactive materials. In the technical sense, such a facility exists on the site of every commercial nuclear power plant. Furthermore, hundreds of such facilities have been operated safely worldwide without any expected or observed damage to man or environment. It is, of course, quite natural and reasonable that in the course of time the spent fuel elements, having cooled down in the local storage pools, be moved to assembly points en route to whatever later treatment is decided upon, that is, to a number of designated major monitored retrievable storage facilities as proposed in the bills under consideration.

SE2 does not see a compelling reason for legislation which would prescribe a rigid period of fuel element storage at such facilities. Rather, we believe that such period should be flexible and guided by the accumulated experience in handling spent fuel elements here and abroad.

Let us now in conjunction with the current debate about proposed MRS's that some try to associate an alleged danger with such facilities which in turn casts a shadow of doubt, concern and even fear on the smaller scale cooling/storage pools at the individual powerplants.

The reasoning process should be exactly the reverse. Since the safety and simplicity of storage of spent fuel elements is an ascertained and recognized fact at every known nuclear power plant or similar research structure, this established safety of such monitored retrievable mini-storages is surely valid also for a properly designed and built larger MRS facility. We at SE2 are fully convinced that appropriately constructed MRSs of the Swedish or similar type as envisaged in the proposed bills will perform their function without endangering in any way our citizens or environment.

Concerning the last element, transportation, of a well-organized nuclear waste handling process, we were unable to find scientific or technological safety-related reasons to support the need for the special treatment called for in some of the proposed legislation. Having followed for 10 years the evolution, enactment and implementation of the routing of shipments of high-level radioactive materials, we note that any state, administrative subdivision thereof, concerned expert or public group has had man years of almost unlimited opportunity to participate in every and all phases dealing with routing and other relevant transportation regulations.

The Department of Transportation spent years, between August 1978 and January 1981, studying and conducting public hearings before promulgating its routing regulation. In fact, in 1980 alone over 1,000 comments were received by the DOT.

According to a Department preview of January 14, 1981 of its new routing rules, the regulations require vehicles carrying high-level shipments such as spent nuclear reactor fuels to use preferred routes, interstate highways or alternative routes designated by the States. The overall aim of the rule is to minimize the possibility of exposure to radioactive materials, avoid heavily populated areas and to minimize travel time.

Under the rule, appropriate State agencies are encouraged to designate preferred routes based on analysis of certain risk factors and careful consideration of the vies of city and county officials.

Where the State does not exercise this authority, carriers of high-level shipments are required to use interstate highways and interstate beltways where possible to avoid center city neighborhoods.

Where there are unusual local situations that are not dealt with by this regulation, they can be brought to the attention of the states or the DOT for special consideration.

While the Department says the use of interstate highways insures a safer route in most cases, it recognizes there are instances where a particular interstate segment may have higher accident rates and that there may be a safer alternative.

The final regulation authorizes States to provide suitable alternative routes for high-level shipments that avoid heavily traveled highways at peak travel times.

These States must consult with city and county officials in the process of selecting routes. If they fail to do so, their selection would be inconsistent with the rule. Consultations should include public notice, solicitation of comments and public hearings if possible.

The rule recommends that each State form an advisory group of city and county officials involved in route selections to advise on the best methods of consulting local communities.

A shipper of high-level materials must prepare route plans and provide copies to DOT within 90 days of shipment. This will enable DOT to develop information on long-term route patterns and inform state and local governments about them.

Drivers of vehicles carrying high-level radioactive materials are required to have additional training every two years on the hazards and emergency procedures for radioactive materials.

These were all quotes.

This seems to us to go as far as possible in meeting the concerns on any relevant level without compromising the effectiveness naturally expected of any good regulation.

The said rule and in particular its assumed sufficiency of surface transportation at the exclusion of maritime or other possible alternatives, has been challenged in the courts. All such challenges have been rejected by the relevant courts, including the U.S. Supreme Court.

It is therefore the considered opinion of SE2 that any additional legislative action on transportation of radioactive materials, high or low level, is superfluous and could be only counterproductive vis-a-vis the stated national goal of the safe and orderly handling of radioactive materials.

In summary, SE2 agrees with the need for reprocessing of spent nuclear fuel elements and supports legislation which would advance practical steps, as outlined in our comments, leading to the resumption of fuel reprocessing in our country as part of a rationally designed U.S. commercial nuclear fuel cycle including ultimate disposal of waste residues.

Two, SE2 strongly supports the parallel continuation on some appropriate level of the current site-specific work on potential geological sites.

Three, we know of no scientific reason which would suggest that all states along a river or over an aquifer affected by the siting of a waste repository should participate in the site selection process. We thus advise against legislation which would stipulate such a requirement.

We assumed that monitored retrievable storage installations constitute a valid and safe component of a rational nuclear fuel management process, and SE2 supports their construction with a cooling off period to be determined by an analysis of the accumulated worldwide experience.

Five, we do not see merit in additional legislative prescription on the transportation of high-level radioactive materials. The current

Federal regulations already respond to all of the concerns raised in the bills under consideration.

I would only add here that, of course, we are also in support of any search for other means of waste disposal like the maritime, deep bed, underwater deposition as long as it can be done in agreement within our international constraints which in many respects often are prohibitive of certain activities on the ocean floor. In other words, find first whether it is useful to do it, and then do it. But if there are prohibitions in advance, I do not see why we should spend money, our money, on something that will not be applicable.

SE2 and its members would be pleased to provide any further clarification of the points set forth in this testimony if this would be helpful to the members of this Senate committee.

Thank you for your attention.

[The prepared statement of Dr. Todorovich follows:]

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Testimony Before The
Senate Committee on Energy and Natural Resources
On S. 1007, S. 1141, S. 1211, S. 1266, S. 1428
Pending Bills Relating to Civilian Radioactive Waste Disposal

The Honorable J. Bennett Johnston, Chairman

Senator from Louisiana

by

Professor Miro M. Todorovich
Executive Director of
Scientists and Engineers for Secure Energy

July 16, 1987

Mr. Chairman, Senators, ladies and gentlemen. It is a pleasure to be able to appear before this committee and testify on behalf of Scientists and Engineers for Secure Energy (SE_2), a public interest group of over 1500 professional scientists and technologists nationwide. Its members share the philosophy that the prudent uses of technology are essential to the maintenance and amelioration of the quality of human life. They are also committed to providing information and analyses to decisionmakers and the public. In furtherance of these purposes, SE_2 conducted in 1979 an international inquiry on nuclear waste disposal which was part of a four-day conference held at Stanford University. SE_2 was also *Amici Curiae* in the City of New York, *et al*. vs. United States Department of Transportation, *et al*. (United States Court of Appeals for the Second Circuit, 1982).

I am a Professor of Physics at City University of New York and have been the Executive Director of SE_2 since 1977.

I appreciate the opportunity to testify on various, mainly scientific and technical aspects embedded in the above mentioned bills being considered by this Senate Committee. Since some of the language in these bills overlaps, permit me to present my comments organized around a sequence of interrelated subjects.

* * * *

The first topic I wish to address revolves around what S. 1266 appropriately characterizes as "a serious disarray" of the current Federal nuclear program (as mandated by the Nuclear Waste Policy Act, NWPA, of 1982) which "requires a substantial mid-course correction." We find to start with a proposal for a two-year study of the feasibility and appropriateness of nuclear waste reprocessing which in this country, as you may recall, was once pursued to the point where we had designed and built an appropriate reprocessing plant at Barnwell, North Carolina. It was an important recycling link in a planned, comprehensive and rational nuclear fuel management scheme of the kind which is now, for example, in full operation in France.

In 1977, however, all non-military reprocessing in the U.S. was stopped not because of any safety or economic concerns and not because someone had doubts about the feasibility of reprocessing, but rather because the then President, Jimmy Carter, entertained the concern that if the United States pursued reprocessing, which was almost at hand (and was to a limited extent actually done earlier at West Valley, New York), other perhaps less responsible countries would follow suit thus increasing the danger of nuclear weapons proliferation. "Reprocessing can lead to greater availability of weapons-grade nuclear fuels," so went the reasoning of Mr. Carter and his advisors, "and thus the United States should, at least for the time being, voluntarily renounce, despite its completed plant, the reprocessing route."

At that same time, President Carter acted to convene an international inquiry, the Internation Nuclear Fuel Cycle Evaluation (INFCE) with the stipulation (a) that the international group (which by the end of its term had delegates representing 56 countries) report to him and the member nations in two years, and (b) that the President of the United States will take the conclusions of the INFCE proceedings into account when deciding, after the two-year interlude, on the future course of spent fuel reprocessing in the United States.

The INFCE group prepared its draft report and statement of conclusion on time which, I was told, failed to gain formal approval only because of the unwillingness of a single delegation (the U.S.) to go along. Subsequently, the U.S. moratorium on reprocessing continued in disregard of the unambiguous INFCE conclusion that spent nuclear fuel reprocessing can be conducted safely and with built-in safeguards against modalities which could lead to increased nuclear weapons proliferation (beyond what is already done by "nuclear club" countries using installations designed to produce weapons grade materials), and despite the earlier promise of our President to be guided by the INFCE findings.

In light of this past U.S. experience, which is worth recalling for the record, and of the fact that the many countries worldwide which now enjoy the benefits of nuclear power are either (a) reprocessing their spent nuclear fuel elements, (b) preparing to do so, or (c) contracting the job out to countries with reprocessing plants, it seems clear that:

1. The United States in 1977 apparently made a wrong turn on the nuclear fuel-cycle issue;
2. The U.S. should promptly consider ways in which to remedy that error (SE_2 is, therefore, fully supportive of a spent fuel reprocessing act);
3. The question is not whether nuclear reprocessing is feasible -- it is done successfully in several countries; and
4. Reprocessing must be economical generally, or must have additional attractive features, otherwise it would not be practiced commercially, elsewhere.

From all this, SE_2 draws the logical conclusions that:

- It would be most appropriate to entrust the American Association of Engineering Societies or some similar practical association or institute with the task of bringing together a Working Group of domestic and foreign technical and scientific experts to review the abundant existing knowledge and analyze foreign experience in the fuel reprocessing and recycling field (including their environmental effects) with a mandate to come up, not later than December 15, 1988 with a set of practical technical proposals for U.S. spent fuel reprocessing.

- Such a set of technical proposals, possibly involving several alternative engineering pathways, should be subsequently submitted for appropriate economic analysis to competent economic research organizations, for example, Resources for the Future, The Conference Board, or the Stanford Research Group. Such an analysis should take into account our regulatory, environmental, financial and labor practices as they affect the suggested engineering solutions and the foreign experience. The target date for such a report should be no later than June 15, 1989.

The proposed time schedule seems to us quite realistic. Let us recall, that a few dozen experts directing the Manhattan project needed less than half a decade to translate the result of a comparatively obscure scientific experiment in nuclear fission performed in 1939 into a fully-developed technology suitable for peacetime as well as wartime purposes. They not only did a feasibility study but also developed the blueprints, and actually produced the necessary hardware and the finished products.

We at SE_2 are quite convinced, given the current case of the specific and specialized reprocessing technology and the extensive available pool of American engineering and economic experts, that the much more modest study envisaged by the proposed bill can be accomplished in eighteen months.

* * * *

The second subject is closely related to the first. If the U.S. were to decide to first reprocess and then later dispose of the much smaller amount of residuals (for which at the time one could find no beneficial use), the whole waste disposal program could become altered by several orders of magnitude -- in spatial volume and in time scale -- and the previously mentioned "mid-course correction" of activities we believe would be in order.

Still, a "correction" need not mean "suspension." While the volume of the radioactive materials may be drastically reduced, the residue will still require permanent disposal. The Swedes and others plan to do this underground in suitable, stable geologic formations. Consequently, site specific work on potential geologic repositories -- albeit on an altered schedule -- should in our judgment continue as a needed component in the overall planning for the handling of radioactive residues.

* * * *

Thirdly, NWPA of 1982 stipulates that states which are candidates for a site participate in the site selection process. Neither our 1979 inquiry, mentioned in the prologue, nor later search have provided us with any peer-reviewed scientific reason which would suggest a widening of this site selection process, i.e. that all states along a river or over an aquifer affected by the siting of a waste repository have cause to participate in the site selection process as provided by the current act. We thus advise against legislation which would stipulate such a requirement.

* * * *

The fourth subject concerns the monitored retrievable storage (MRS) of radioactive materials. In the technical sense, such a facility exists on the site of every commercial nuclear power plant. Furthermore, hundreds of such facilities have been operated safely worldwide without any expected or observed damage to man or environment. It is of course quite natural and reasonable that in the course of time, the spent fuel elements, having cooled down in local storage pools, be moved to assembly points (enroute to whatever later treatment is decided upon), i.e. to a number of designated major monitored retrievable storage facilities -- as proposed in the bills under consideration. SE_2 does not see a compelling reason for legislation which would prescribe a rigid period of fuel element storage at such facilities; rather we believe that such period should be flexible and guided by the accumulated experience in handling spent fuel elements here and abroad.

Let us note in conjunction with the current debate about proposed MRSs, that some try to associate an alleged danger with such facilities which in turn casts a shadow of doubt, concern and even fear on the smaller-scale cooling/storage pools at individuals power plants.

The reasoning process should be exactly the reverse. Since the safety and simplicity of storage of spent fuel elements is an ascertained and recognized fact at every known nuclear power plant or similar research structure, this established safety of such monitored retrieveable mini-storages is surely valid also for a properly designed and built larger MRS facility. We at SE_2 are fully convinced that appropriately constructed MRSs (of the Swedish or similar type) as envisaged in the proposed bills will perform their function without endangering in any way our citizen or our environment.

* * * *

Concerning the last element -- transportation -- of a well-organized nuclear waste handling process, we were unable to find scientific or technological, safety related reasons to support the need for the special treatment called for in the proposed legislation. Having followed for ten years the evolution, enactment and implementation of the routing of shipments of high-level radioactive materials, we note that any state, administrative subdivision thereof, concerned expert or public group has had many years of almost unlimited opportunity to participate in every and all phases dealing with routing and other relevant transportation regulations.

The Department of Transportation (DOT) spent years (between August, 1978 and January, 1981) studying and conducting public hearings before promulgating its routing regulation. In fact, in 1980 alone over one thousand comments were received by the DOT. According to a Department preview of January 14, 1981 of its new routing rules:

> The regulations require vehicles carrying high-level shipments, such as spent nuclear reactor fuel, to use "preferred routes" -- Interstate highways or alternative routes designated by the states. The overall aim of the rule is to minimize the possibility of exposure to radioactive materials, avoid heavily populated areas and to minimize travel time.
>
> Under the rule, appropriate state agencies are encouraged to designate preferred routes based on analysis of certain risk factors and careful consideration of the views of city and county officials.
>
> Where the state does not exercise this authority, carriers of high-level shipments are required to use Interstate highways and Interstate beltways where possible to avoid center-city neighborhoods.
>
> Where there are unusual local situations that are not dealt with by this regulation, they can be brought to the attention of the states or the DOT for special consideration.
>
> While the department says the use of Interstate highways ensures a safer route in most cases, it recognizes there are instances where a particular Interstate segment may have higher accident rates and that there may be a safer alternative.
>
> ...[T]he final regulation ... authorizes states to provide suitable alternative routes for high-level shipments that avoid heavily traveled highways at peak travel times.
>
> The states must consult with city and county officials in the process of selecting routes. If they fail to do so, their selection would be inconsistent with the rule. Consultation should include public notice, solicitation of comments and public hearings if possible.
>
> The rule recommends that each state form an advisory group of city and county officials involved in route selection to advise on the best methods of consulting with local communities.
>
> A shipper of high-level materials must prepare route plans and provide copies to DOT within 90 days of shipment. This will enable

DOT to develop information on long term route patterns and inform state and local governments about them.

Drivers of vehicles carrying hight-level radioactive materials are required to have additional training every two years on the hazards and emergency procedures for radioactive materials.

This seems to us to go as far as possible in meeting concerns on any relevant level without compromising the effectiveness naturally expected of any good regulation.

The said rule and, in particular, its assumed sufficiency of surface transportation at the exclusion of maritime or other possible alternatives, has been challenged in the courts. All such challenges have been rejected by the relevant courts including the United States Supreme Court.

It is therefore the considered opinion of SE$_2$ that any additional legislative action on the transportation of radioactive materials, high- or low-level, is superfluous and could be only counterproductive vis-a-vis the stated national goal of a safe and orderly handling of radioactive materials.

In summary, SE$_2$:

(1) Agrees with the need for reprocessing of spent nuclear fuel elements and supports legislation which would advance practical steps -- as outlined in our comments -- leading to the resumption of fuel reprocessing in our country as part of a rationally designed U.S. commercial nuclear fuel cycle including ultimate disposal of waste residues.

(2) Strongly supports the parallel continuation on some appropriate level of the current site-specific work on potential geological sites.

(3) Knows of no scientific reason which would suggest that all states along a river or over an aquifer affected by the siting of a waste repository should participate in the site selection process as provided by the current Nuclear Waste Disposal Act (1982). We thus advise against legislation which would stipulate such a requirement.

(4) Monitored Retrievable Storage installations constitute a valid and safe component of a rational nuclear fuel management process and SE$_2$ supports their construction with the cooling-off period to be determined by an analysis of the accumulated worldwide experience.

(5) Sees no merit in additional legislative prescription on the transportation of high-level radioactive materials; the current Federal regulations already respond to all of the concerns raised in the bills under consideration.

SE$_2$ and its members would be pleased to provide any further clarifications of the points set forth in this testimony if this would be helpful to the members of this Senate committee.

Thank you for your attention.

Senator HECHT. Thank you very much, Professor. I appreciate it.

Let's start from the back to the beginning. Let me just count here. I have a staff-prepared memo. There are 29 countries that have nuclear power plants today, which I have down here. So, disposal of nuclear waste is not something total just in America. It is a worldwide problem.

Dr. TODOROVICH. Yes, sir.

Senator HECHT. Let's start off with the seabed disposal concept. If that would be found to be very, very safe, then all countries could do it at that particular time. Dr. Teller expressed to me that we should pursue this very strongly, and you just said the same thing. Would you like to go further on that?

Dr. TODOROVICH. It is well-known that almost all—the majority—almost all rocks that we encounter when we do an excavation, road-building and so on, are of sedimentary origin. I say almost all. There are others. These sedimentary rocks have been produced once upon a time in the ocean floor, at some ocean floor by very many millions of years of deposition of materials which first had to be hardened there and then had to undergo again millions of years of earth's crust convulsion until they finally surfaced on the surface of the earth and we could see them.

So out of that, let's first draw the first two main facts. One, that on certain ocean floors at all times there are places where new such rock formations are being created. And if one deposits something on those places, whatever one deposits there becomes very effectively embedded into the fundamental sedimentary rock that is being at this time created there like other rock formations that we see today have been created millions of years ago.

And the second fact is that such a deposited thing will not have a chance to come again to the surface of the earth for a much longer period of time than is necessary of any radioactive material that is put there to finally safe-destruct. And very often this safe-destruct feature of radioactive materials, which is actually a positive thing compared to any other hazardous material which may like Mercury or so exists forever—these things do not exist forever. And this is a good thing because you can put them somewhere where they will be sheltered long enough. And if they ever come to the surface, and after a billion years a Martian lands and finds it will be only a residue from which—if they know science—they will be able to determine that it was put there by some other civilization many, many billions years ago, but that piece of rock would be totally safe.

So, yes, this is one of the most simple methods that we could envisage if you, A, would clearly delineate where today on the ocean floor such places exist, and second, of course, whether if we can persuade the international community of nations, that we jointly undertake such a venture—in other words, that we agree that it is a good use of the ocean floor for such purposes.

Just when you said how many nations are involved in having nuclear power plants, you gave me an impetus to think that this is maybe politically even a good route to go in parallel of whatever we do otherwise for the temporary intermediate solution.

Senator HECHT. You know all these countries. I do not have to read them, do I?

Dr. TODOROVICH. Yes.

Senator HECHT. Argentina, Australia, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, Finland, France, West German, East Germany, Hungary, India, Italy, Japan, Korea, Netherlands, Norway, Pakistan, Philippines, South Africa, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States, U.S.S.R., Yugoslavia, and now there might be more, but I do know about this.

Dr. TODOROVICH. It's enough.

Senator HECHT. That's enough.

It is an international problem.

Dr. TODOROVICH. Yes.

Senator HECHT. And we started, as you said and everyone has said—in the 1970's we had the ability and the technology to reprocess. We dropped it. Other nations picked up the ball and probably when we get down to it, we will hire them to come back and do it for us. Is that a possibility?

Dr. TODOROVICH. Well, it is a very strange thing which is often not mentioned that in my own state of New York where we are so much making a case of one finished nuclear power plant, which cannot get on line, and to remedy for the lack of power we are buying Canadian electricity which comes to us under the label of Hydro Quebec, of Hydro Ontario.

I visited some of my relatives in Toronto. Well, Hydro Ontario has 15 miles from the center of downtown Toronto a Pickering Nuclear Power Plant which has eight reactors working full speed to produce that electricity which we are then paying with hard-earned dollars and increasing our trade deficit.

Now, what we are doing here with power we'll soon be doing with spent fuel. If we cannot do it ourselves, we will have to contract someone else to do it. It is something that simply I think is a partial result of what I said at the beginning, that the decisionmaking was yielding more to simple pressures from too many sides, which are natural in a democracy, but which the political realities should be able to handle in a meaningful way. After all, why do we have political scientists? Why do we have administrative experts? Why do we have people in Congress but to wrestle with the difficult problem of satisfying many interests and yet come with a solution which is, A, feasible and second in the long run in the interests of everyone.

Senator HECHT. Well, we were in France. You talk about hypocrisy. Scientists there mentioned that France sells nuclear energy to certain areas of Europe that are absolutely anti-nuclear in every aspect, but they buy the nuclear energy from them.

Dr. TODOROVICH. But we are buying from the Canadians. I just mentioned.

Senator HECHT. That's the reason I brought that back to you.

Dr. TODOROVICH. Yes. And the French are making currency, good dollars or francs, or whatever you call it, on that export. They are exporting to West Germany. They are exporting to Italy. They are exporting to Britain. And Britain is, of course, trying to catch up with the program. At one point they were lagging using our type of reactors, which they approved just two years ago.

Elsewhere in the world the progress is moving forward while we are suggesting newer and broader commissions to digest what is elsewhere quite obvious.

As you were asking me the question, I remembered the saying of that quite famous Spanish thinker. Those who do not learn about history are condemned to repeat it. We sometimes seem to joyfully not want to learn from history, and almost masochistically submit ourselves to the punishment afterwards.

Senator HECHT. Thank you. I appreciate your off-the-cuff remarks because they are very appropriate. And as I said, the fact that we do not have the other Senators here—your words will be repeated because they will be a matter of the official record. And I will make sure they are repeated because I will repeat them often.

Let's just go back. Although you spoke about the different legislation, let me just go back to S. 1266—Mr. Evans and Murkowski and myself—about the four MRS facilities.

Do you feel there should be four, there should be eight, there should two? I mean, is there any number in your mind that might—from your testimony you like the concept as an intermediate phase.

Dr. TODOROVICH. First, it is feasible. Second, if it is more than one, we are minimizing the transportation distances and this is a consideration to be taken into account.

The number—well, if France with 50 powerplants can work with one repository, maybe we being a whole continent and having upwards of 100 powerplants possibly should have something like four.

Senator HECHT. That is a reasonable amount.

Dr. TODOROVICH. Yes, yes.

Senator HECHT. All of this legislation, you understand—what we have done or what I have done—throw it out on the table, ask people like yourself to start dissecting it. Then we can come up with something. But basically in your opinion four seems to be a good round figure to start with.

Dr. TODOROVICH. I said for both reasons of sufficiency of capacity and second, if spaced properly over the continent of North America, it can reduce the travel distances for supplying the—from the places of production.

Senator HECHT. OK. The subseabed disposed bill, S. 1428—you spoke about that. And we should absolutely in your opinion continue research on it. And it might be a possibility for all nations.

Dr. TODOROVICH. Prod the administration or whatever to take a leading role with other countries in the world which you listed before to look at the question of use of the seabed also from this very productive vantage point.

Senator HECHT. Now, the storage bill, S. 1141, which I picked a figure of 50 years during which the spent fuel should be cooled down. Certain experts in France mention 40 years. Now, Mr. Rusche mentioned the first 20 years, but this is contrary to what we heard in France because the scientists said the decay in heat and radiation during the first 40 years is dramatic, and after that it begins to slow down. Would you address that?

Dr. TODOROVICH. I would say that here we are actually not having such a great difficulty because many of these fuel elements in the United States have already stayed for quite a while where they have been used.

Senator HECHT. Yes, but we also have to plan for the future.

Dr. TODOROVICH. No, but I mean so if we make a transition assuming that the first batch may be already 20 years old, if you add another 20 years, in the first MRS you have already 40 years. And in the process of that, one can—you see, the point is not really when is the lowest residue of radiation intensity or so, but if one then goes into the reprocessing mode, where do the curves cut. That is why I say maybe a totally rigid number would not be appropriate. But one can use benchmarks if you wish.

Senator HECHT. I fully understand if you go into the reprocessing, but under the present law we are not reprocessing.

And do you feel that there is a significant decline in radioactivity from 20 to 40 years?

Dr. TODOROVICH. If you really want to pin me down with the limited knowledge, I am not an expert on that. I would work for more than 30 rather than less than 30.

Senator HECHT. You would work for what?

Dr. TODOROVICH. More than 30 rather than less than 30.

Senator HECHT. More than 30 rather than less than 30, okay.

[Additional information on this subject is provided in post-hearing questions and answers.]

Dr. TODOROVICH. And I know also that Senator Evans was kind of flexible saying that one can look at the matter and not necessarily have an absolute prohibition, rather a target with some flexibility if appropriate.

Senator HECHT. We have to have some figure to start talking about. So, I threw out the figure 50 years. And also, I pointed out to Mr. Rusche that France still has not prepared a deep level repository. So, if France is over 40 years, it might be 70 or 80 years. It might be 120 years.

Dr. TODOROVICH. With all due commitment to my scientific upbringing, I cannot but also notice that some of the reverberation of that kind of decision does affect also the public perception of whether something is safe or not. And I therefore do understand the concern of Mr. Rusche that we in some way make the public believe that we actually know how to come to the end point of final disposal, and therefore neutralize some of the allegations that "no one knows how to dispose of nuclear waste," and then manage to scare people to the point that what I saw on television happening during some hearings in the State of Maine was scary for a scientists.

The public—it was in some big auditorium where the DOE had a hearing that from the time of the movies that I saw about the Nazi meeting in Nuremberg, there was not such an organized political outcry against something that actually is not dangerous. And therefore, while on the one side the purely scientific judgment would be fine if one could apply it alone.

I understand that Mr. Rusche does not like to hear 120. He tries to live with 40 or 30, or would like even to have a bore hole to tell his critics that when all this is said and done, he will be able to put it into the ground and close it or into the seabed or whatever.

I am saying this just from experience of what I have seen people have to undergo.

Senator HECHT. Well, that is his job to put it somewhere. And he is following the law the way it is written today. And my whole philosophy is before we go and start spending billions and billions of dollars, if the current law is flawed, why do we follow it blindly when other scientists around the world have said this is not the proper way to go?

Dr. TODOROVICH. Well, I think that our suggestion that somehow a clear task and what we suggested about the reprocessing route can be applied to any other, that it be asked from competent, technical—you see, we think the National Academy of Science, despite its great prestige, is not the best forum to be asked to address things that have been already many, many times addressed on that level of fundamental understanding. And one needs now to rather see how to build a device. There I think if one would give a clearly defined task to some of—and there are many good technical and economic groups in the United States—and then get that back to you in Congress and in the administration branch of the government, that we could do a tremendous forward move.

And these people who would be doing this could then come and appear here before a hearing like this not individuals expressing their opinion, but as bodies which have tried their best to participate in the decision making process as experts and are trying to be helpful in bringing to you packages which are well thought out, and maybe more than one so that then the elected people can decide which of the ones they feel like best to choose and to pursue.

Senator HECHT. I could not agree with you more. But public opinion and political hysteria has become part of scientific knowledge unfortunately.

You mentioned reprocessing. That is the last of the bills. Let me ask you a direct question. Does it make any sense at all to reprocess military waste and not reprocess civilian waste?

Dr. TODOROVICH. I think it is obvious. The answer is no. It makes no sense whatsoever.

Senator HECHT. There is no sense at all to have a deep level nuclear repository and have half of it reprocessed and the other half not reprocessed.

[Additional information related to this issue is included in posthearing questions and answers.]

Dr. TODOROVICH. Senator, you hear from my accent that I was not born in an English speaking country although I try to improve. And so, I was once there, and we were looking at this country, which is now mine by choice, by clear, deliberate choice, with a lot of envy at that time about 30 or so years ago. The United States was viewed as a country of possible impossibilities. What usually no one else could do, the Yankee, or whatever you want to call it, was able to do and was envied and admired by the rest of the world.

It is kind of surprising that we have in this short span of time somehow lost this capacity of addressing the issue squarely. And as a consequence of that, you have this situation that you just asked me. You have two wastes just from two origins. One goes matter of factly; the other spins an enormous amount of legal paperwork, discussions—name it.

Is it logical? Of course not. The question is really how did we get into that kind of schizophrenia, and what to do to get ourselves out. And I believe that if we would just start applying a little bit of straight, old-fashion rationality, and if it would become seen as being applied and effective—you know, there has been a lot said about the media. They are biased and this and that. One thing I have found, however, they always report what happens even if they do not like it. They—whoever. And if we do the right thing, and we just continue to build one brick on the other, and explain it and justify it—and there are many, many good, eloquent people with better English accent than I have who will come here and level with you and say why they think so, people who will sit on that transportation cask with the radioactive material because they know that it is not dangerous. And they will be willing to demonstrate it with their bodies if necessary.

That kind of thing then makes news. And that kind of news then begins to improve public perception.

It's a need for a partnership. I hope it will be again accepted as once I think the scientific community was accepted in this country and was considered the promoter of the better life for everyone. And better life did not mean just more air conditioners, bigger cars and so on.

You know, any time I teach my liberal arts students, I point out to them that none of those ideas that they come with to my classes, human equality, rights, good medical care, the opportunity to be taught in a school or college—all this rests on the availability of inanimate power, energy. That is what we are talking about, not the profit of a corporation or maybe something being done wrong over here.

We have for the first time in this civilization with the use of the scientific principles made possible the implementation—albeit it maybe not absolutely, but we can strive for it—those ideas that the old Greeks, the old Romans, the old Egyptians had but were never able to implement because human muscle and animal muscles are very weak. And when we teach and learn something about Greek democracy of old times, it was a democracy for maybe 15 percent or 10 percent of the population of those islands. The other 85 percent had to slave twice or three times or five times harder so that Plato or some Olympic runners could do their things.

That is what makes some of us scientists so die-hardly convinced to try to explain again to our fellow citizens what is at stake and what we have thought to have created for the good of all of us and our posterity. And if you give us more of such opportunity to come and speak to you, maybe, just maybe, we will begin to improve the perception which then reflects itself in so many other ways.

Senator HECHT. I fully intend to. And you mentioned your English. Let me just say to you that six Senators and the staff that went over to France—we learned more through an interpreter by scientists who could not speak any English at all than probably we have learned in this room right here. So, that is not at all a factor.

Just for the record, isn't it far safer to transport reprocessed waste than unreprocessed waste?

Dr. TODOROVICH. Well, let me break into two parts. The transport—you cannot avoid the first part when it goes into the 40 year repository.

Senator HECHT. Yes.

Dr. TODOROVICH. The second part is once you reprocess, the rest of—not just transportation, but the disposal is incredibly simpler.

Let me just give this number——

Senator HECHT. Slow on that because this is a——

Dr. TODOROVICH. Let me speak off the top of my head. When you have a new nuclear fuel element for reason of even security, nonproliferation and so on, only about 3 percent of the fuel is burnable fuel. The other is kind of a filler.

Now, if you take this——

Senator HECHT. Only 3 percent of the waste?

Dr. TODOROVICH. Of the fuel element is burnable.

Senator HECHT. Yes.

Dr. TODOROVICH. The rest is filler.

Senator HECHT. OK.

Dr. TODOROVICH. Once this is a spent element, the filler is still there, more or less. And then there is some of those things that have been burned out because they produced energy. If we take now that thing and try to transport it and put it into a repository and so on, we are putting the whole thing as if we would take our whole blood because it passed through our body and then try to throw it away and create new blood all from scratch.

Biology has solved this very simply. The thing goes through kidneys, is reprocessed, and only the small part of the real waste from the blood is then taken out of us. The rest is returned to our body.

Well, the same holds for what happens with spent fuel elements where the majority of the stuff goes back into either filler or practical use. And the amount that has to be then taken care of by transportation or disposal is much, much smaller.

Again, any Yankee 50 years ago would see any other solution as ridiculous. For some reason, we are more mesmerized in looking for complications than trying to take the simplest road from here to there.

Senator HECHT. A figure that came to us while we were in France is in the area of 95, 97 percent can be done away with by reprocessing.

Dr. TODOROVICH. Well, that is the balance to the 3 percent of what is——

Senator HECHT. Oh, OK. So, that is an accurate figure then.

Dr. TODOROVICH. Yes.

Senator HECHT. OK. Now, let's get back to the crux, one of the first questions I asked you.

The concept of not putting this material into the ground that could be usable—after this is reused, and the final residue—will this be radioactive with any plutonium or anything? How much can be burnt out finally?

Dr. TODOROVICH. Well, if the reprocessing is properly done, you can extract whatever you do not want to consider as a waste. And so, even the concept of waste is a very unclear thing until one talks about all end uses. You know—you may have heard, Senator, that some of the so-called waste products from radioactive fission are actually proposed to be used as a purifier in the loose term of the word of municipal wastes. By high intensity radiation, they would be cleaning up municipal wastes from complex compounds or from some contiguous things.

If you then assume that suddenly that portion of the waste from a power plant becomes a raw material for some next use, you are even further reducing the amount of what you have to dispose.

Plutonium surely can be taken out and reburned. Many of the waste products are actually isotopes which can be used in medical research or biological or other research. Of course, usually there is produced more of it than we can need.

So, ultimately, like in the case of what I learned when I was a kid that in a well-organized use of animals which we use also for our food consumption—in a well-organized thing, everything from hide, from gristle and the bones can be ultimately used. And so there is almost no waste coming at the end inside of the cycle.

In that sense, I cannot give you an answer in a sense 2 percent or 1 percent finally. At most 3 percent—that's correct if we do not make any further uses of anything that comes out of the powerplant. Less than 3 percent if we start utilizing also other materials there which are waste for the nuclear power plant as a raw material for something else.

Senator HECHT. Now, you mentioned you can take all the plutonium out of it.

Dr. TODOROVICH. Yes.

Senator HECHT. This is what people fear the most. It has the longest half-life.

Dr. TODOROVICH. Yes. There are a few other transuranic which also have a long half-life.

Senator HECHT. Can these be taken out?

Dr. TODOROVICH. But the question is what to do with them. They have to be ultimately disposed.

Senator HECHT. Can they be used again, reused?

Dr. TODOROVICH. No. Usually I do not know of any good use for them. You see, it depends on what kind of nucleus it is. Some can give you energy. Some need not now.

There is one further point here to be made. Even these very long-lived transuranics and some others which would constitute at this time that residue which may last many, many, many years——

Senator HECHT. How long?

Dr. TODOROVICH. Several tens of thousands of years.

Senator HECHT. OK, the figure 10,000 years is always bandied around.

Dr. TODOROVICH. One can subject them to bombardment by neutrons and transmute them into element which die out faster. That is possible.

Senator HECHT. The French are working on this, and they explained this to us.

Dr. TODOROVICH. I understand from some friends in Oak Ridge who have talked about that that the problem was only economic, that if you use neutron flux of the type that you have in reactors, it costs a lot. If we ever will go to also have fusion energy production, then the neutron fluxes there will be so high that this becomes another practical way of reducing the amount of long-lived residues, and have essentially only quicker self-destruct material to handle which within two lifetimes or three lifetimes of human beings are already back to the original background from which they came.

Senator HECHT. Following along—again we are happy to have you on the record.

Following along on this train of thought, if we have the intermediate facilities and continue this reprocessing and research, would it be possible to eliminate the need for a deep level repository?

Dr. TODOROVICH. In principle, philosophically, it would be a possibility. It would be a possibility.

I am only here being cautious in the sense that when I gave that example how a discovery of fission obscure really it was except in the very small group of people who knew what was going on—of nuclear fission in 1939. Once that discovery was there, it was clear that one could hop from one step to another to another. And that was the story of the Manhattan Project.

If you talk, on the other hand, about cancer research, we have all these wars on cancer. But as a scientist—and no scientist can here be that predictive because there are still things that are not clearly known. In the case of destruction—transmutation—let's call it correctly what it is—of very long-lived residues from a nuclear power plant into short-lived things which die out in a reasonable time, whichever that is—100 years, 150 years or so—I am not sure today that except for the principle of it that enough data we have that was not an area which was—I may be talking out of ignorance. You may know more having been in France recently than I. I wasn't there.

But in principle, philosophically, it is a possibility to contemplate, and perhaps it is one course that should not be avoided of research and inspection.

Senator HECHT. The French, as I told you, scientists told us about the bombardment. And they also—some of them spoke independently—said they feel by the year 2020 France will have breeder reactors that would take further use of a lot of waste. Would you expand on that?

Dr. TODOROVICH. Well, they have already an operating breeder reactor, the Super Phoenix, which is not just a prototype but a plant as good in production of electricity as any other that we have. And I think the Soviets are not far behind on that.

It is only a question of economy there at this time while the cost of uranium and the availability of it is still as it is that one need not go out of the utilization of mined uranium and produce energy.

Scientists who were about 30 or 40 years ago speculating about ideal systems liked the idea of breeders not only because of the necessity of power, but also because it avoids the need for further extended mining of uranium. You do not like to send people underground if you can have other ways in which you can do the trick. And there was a lot of thought given to systems which can be more elegant, more environmentally benign and technically advanced.

It was unfortunately in our country the development of the fear element which has brought us to have to travel abroad to see what is newest and most promising.

Senator HECHT. It is my opinion—I do not know whether you will share it with me—that we have to have power in America.

Our oil is definitely running out. And we have to look in our position as U.S. Senators to project 50, 100 years. We are celebrating today the 200th anniversary. We have to plan the next 200 years. And without nuclear fuel, I cannot see an alternative down the line. Do you know of another alternative?

Dr. TODOROVICH. First the answer is no, if we want to remain economically competitive.

You may have heard sometimes that if you drill deep enough, you can always find a barrel of oil or another cubic yard of gas or so. The point is, of course, that if the energy spent to get that barrel of oil is equal to another barrel of oil, we are at below the breaking point even physically, not to talk about economy. These are limitations.

Not to say also that other sources of energy and very often the mention is made of coal. And you know that of coal we could artificially create synthetic fuels, and there are here possibilities which were tried already during wartime in Germany.

But while I am the last to try to spread another kind of fear, it is fair to say that the residuals that come from burning any fossil fuel or any fuel containing carbon does cause question marks on the COE emission and heating of the atmosphere and the acid rain in certain cases, which are all problems which are much more difficult to technically contain and control than anything connected with nuclear power.

In other words, even if we in the United States—we are one of the rare countries where the amount of coal permits us a degree of luxury that others do not have to say, well, even if there is no oil, we can somehow—we do not know how—pursue the matter. The question arises whether this is the most reasonable thing to do even on an environmental position that one may take.

Nuclear power has so many positive features on any level, if one is willing to really fairly and objectively look at it, that it is not only on the basis that it is the only thing available sometimes in the near future that we have to pursue it.

But let mention another thing that is these days perhaps again pretty—or should be pretty understood and has been somehow overlooked. We have a lot of problems on the international level in the Middle East, as you know. And to a large extent these problems are there because they are financed actually by the selling of oil to the Western World by those countries. And therefore, by not ourselves producing enough of a share of energy that we use, and buying it from that area, we are doing them actually a disservice because these countries then can engage in protracted wars and acts of terrorism, of internal turmoil, which would never happen if someone was not having a huge amount of cash which was automatically flowing from the west and was at the disposal of people who apparently are not sufficiently up to maturity not to use these available funds for the purposes that they are using.

In other words, by not reducing our consumption of certain kinds of energy resources and relying on these supplies, we are, if we want to take some of this moral term talking, guilty for the perpetuation of certain troubles in that part of the world which would be eliminated if there was just less cash flow going there. If we could tell some of those people, drink your oil if you wish, but we can be self-sufficient, they would be possibly better off, less killings among countries and all that. It happens this way by us supplying enough money to buy weapons, to buy food, to buy everything to perpetuate a foolishness.

Senator **Hecht**. Well then, in order to continue our nuclear energy program, it is incumbent upon us to immediately come to grips with the problem of nuclear waste because we cannot build more power plants until we come to grips with this. Do you agree on that?

Dr. **Todorovich**. Most certainly on both normal, technical reasons and the perceptional reasons because even if one could say that having the retrievable storage one could extend the cooling off 150 or 200 years, and then maybe find another way of doing it, that won't wash well with the public at large. It looks like a coverup for ignorance. And yet, there is no ignorance. We know how to proceed and, therefore, we have to look to these options and really show the American public that we know what we are doing.

Senator **Hecht**. Thank you very much. For the record, I want to insert a statement by Senator Johnston.

[The prepared statement of Senator Johnston follows:]

STATEMENT OF SENATOR J. BENNETT JOHNSTON

CHAIRMAN, COMMITTEE ON ENERGY AND NATURAL RESOURCES

HEARING ON PENDING NUCLEAR WASTE LEGISLATION
JULY 16, 1987

TODAY THE FULL COMMITTEE WILL CONTINUE ITS HEARINGS ON NUCLEAR WASTE DISPOSAL. SINCE JANUARY, THE COMMITTEE HAS CONDUCTED A COMPREHENSIVE SERIES OF OVERSIGHT HEARINGS ON THE DEPARTMENT OF ENERGY'S IMPLEMENTATION OF THE NUCLEAR WASTE POLICY ACT OF 1982. TODAY WE WILL RECEIVE TESTIMONY FROM WITNESSES ON PENDING LEGISLATION TO AMEND THE 1982 ACT.

THE BILLS BEFORE THE COMMITTEE TODAY -- S. 1007, S. 1141, S. 1211, S. 1266, AND S. 1428 -- ENCOMPASS A WIDE RANGE OF IDEAS FOR CHANGING THE DIRECTION OF THE NUCLEAR WASTE PROGRAM LAID OUT IN THE 1982 ACT.

SENATOR HATFIELD'S BILL, S. 1007, WOULD ALLOW AS MANY AS 9 ADDITIONAL STATES TO PARTICIPATE IN THE SITING OF A NUCLEAR WASTE REPOSITORY. ONE OF SENATOR HECHT'S BILLS, S. 1141, WOULD RESTRUCTURE THE NUCLEAR WASTE PROGRAM TO RELY ON LONG-TERM STORAGE OF SPENT FUEL FOR 50 YEARS OR MORE PRIOR TO DISPOSAL IN A GEOLOGIC REPOSITORY. SENATOR HECHT'S OTHER BILLS, S. 1211 AND S. 1428, WOULD DIRECT THE DEPARTMENT OF ENERGY TO DO FURTHER STUDY OF THE BENEFITS OF REPROCESSING SPENT FUEL PRIOR TO DISPOSAL AND FURTHER STUDY OF THE CONCEPT OF SUBSEABED DISPOSAL. FINALLY, SENATOR EVANS' BILL WOULD ESTABLISH A SYSTEM OF REGIONAL MONITORED RETRIEVABLE STORAGE FACILITIES AND DEFER THE SEARCH FOR A PERMANENT GEOLOGIC REPOSITORY.

LET ME STATE AT THE OUTSET THAT MY PREFERRED COURSE OF ACTION WOULD BE TO STICK WITH THE PROCESS LAID OUT IN THE 1982 ACT. IT IS NOT A PERFECT LAW, BUT IT IS A GOOD LAW. AND IT WAS PASSED AFTER MANY YEARS OF HARD WORK. A SUBSTANTIAL AMOUNT OF WORK HAS GONE ON SINCE THE ACT WAS PASSED AND SIGNIFICANT RESOURCES HAVE BEEN EXPENDED. I BELIEVE THAT THE HEARINGS WE HAVE HELD IN THE COMMITTEE HAVE PROVIDED CONVINCING EVIDENCE THAT THERE IS NO TECHNICAL REASON TO HALT THE PROGRAM AT THIS POINT.

UNFORTUNATELY, I HAVE BECOME CONVINCED THAT DETERMINED ATTEMPTS WILL BE MADE TO AMEND THE NUCLEAR WASTE POLICY ACT IN THIS CONGRESS. SOME OF THE PROPOSALS I HAVE SEEN WOULD, IN EFFECT, REPEAL THE ACT AND SEND US BACK TO WHERE WE WERE IN THE MID 1970S WHEN PLANS FOR A NUCLEAR WASTE MANAGEMENT POLICY WERE FIRST BEING SERIOUSLY STUDIED. I THINK THIS WOULD BE A TRAGIC MISTAKE AND A WASTE OF THE HARD WORK AND SUBSTANTIAL RATEPAYER FINANCIAL SUPPORT THAT HAS GONE INTO THIS PROGRAM.

I HOPE THAT WE WILL NOT TAKE THE PATH OF LEAST RESISTANCE AND CLOSE DOWN THE PROGRAM IN ORDER TO STUDY THE PROBLEM FOR THE NEXT DECADE OR LONGER. I HOPE THAT INSTEAD WE CAN AGREE ON SOLUTIONS

THAT WILL MOVE US TOWARD THE GOALS OF PERMANENT DISPOSAL THAT WERE LAID OUT IN THE 1982 ACT.

TODAY WE WILL HEAR FROM THE DEPARTMENT OF ENERGY, AFFECTED STATES, AND INDIAN TRIBES ON THE PENDING LEGISLATION. TOMORROW MORNING THIS HEARING WILL CONTINUE AND WE WILL HEAR FROM PUBLIC WITNESSES.

THE FIRST WITNESS THIS MORNING WILL BE MR. BEN RUSCHE, DIRECTOR OF DOE'S OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT.

Senator HECHT. Do you have a few more minutes?

Dr. TODOROVICH. Yes, sir.

Senator HECHT. What I would like to ask—I am going to call this hearing to a close and remind everyone that we will continue at 8 o'clock in the morning with some more witnesses. But if you would not mind sitting here a few minutes, several members of the staff went to France with us. And I would like to ask them if they have any questions to ask of you.

I will now adjourn the hearing.

[Whereupon, at 1:20 p.m., the hearing was recessed, to reconvene Friday, July 17, 1983.]

CIVILIAN RADIOACTIVE WASTE DISPOSAL

FRIDAY, JULY 17, 1987

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 8:02 a.m., in room SD-366, Dirksen Senate Office Building, Hon. Daniel J. Evans, presiding.

OPENING STATEMENT OF HON. DANIEL J. EVANS, A U.S. SENATOR FROM THE STATE OF WASHINGTON

Senator EVANS. It is 8 o'clock. And we are delighted to be able to continue this hearing even at this early hour, and particularly pleased that you gentlemen were willing to come at this early hour on what I consider and I know Senator Hecht considers to be an extraordinarily important hearing and series of witnesses.

In this session of Congress I think it will be necessary, certainly desirable, to modify our Nuclear Waste Policy Act to give us a change in direction or, for that matter, if it is the Congress' choice, to ratify the current direction that we are now taking in nuclear waste.

The one thing I think all of us can agree on unanimously is that we have some serious problems with the current actions or controversies which surround nuclear waste and its disposal. And there are many in Congress who at this point would prefer simply to postpone for another couple of years any further action while awaiting the results of a special commission and their analysis of what ought to be done.

I am not sure that I really agree with that proposition. I think that is the job of Congress, to make some decisions, to have some analysis, and from that to give direction to the Department of Energy and others on this particular matter. And of course, that is why we are having this hearing.

Before we start with the witnesses, Senator Hecht, do you have an opening statement?

STATEMENT OF HON. CHIC HECHT, A U.S. SENATOR FROM THE STATE OF NEVADA

Senator HECHT. Thank you very much.

Just for the record, I think these hearings have been very fruitful. Yesterday afternoon we had some wonderful witnesses that absolutely challenged the course that we are taking in nuclear waste in America, and felt that we should go back to the direction we were headed in the 1970s before President Carter stopped our path to recycling.

And if I may just quote from Professor Miro Todorovich, who was with us for about an hour and 45 minutes yesterday, just one little part. "It was an important link and a planned comprehensive nuclear fuel management scheme of the kind which is now, for example, in full operation in France."

So, Mr. Chairman, I agree with you. We do not need another committee. We know the direction to go. The direction has been used in other countries. They have taken over our technology. Let's face up to the issue and let's proceed.

Thank you.

Senator EVANS. Thank you very much.

Our first panel is represented by Dr. Alvin Weinberg, Institute for Energy Analysis from Oak Ridge, Tennessee; Mr. Sol Burstein, Vice Chairman, Wisconsin Electric Power, Milwaukee, Wisconsin, speaking on behalf of the American Nuclear Energy Council and the Edison Electric Institute; Mr. Nolan Hancock, Washington Legislative Representative of the Oil, Chemical and Atomic Workers Union from Washington, D.C.

Let's start with Dr. Weinberg. It is a pleasure to welcome you back to this chamber. This is getting to be a familiar place for you.

STATEMENT OF DR. ALVIN M. WEINBERG, INSTITUTE FOR ENERGY ANALYSIS

Dr. WEINBERG. I have agreed to comment on the proposed amendments to the NWPA, S. 1141, S. 1211, and S. 1266 whether I believe some publicly acceptable resolution of the waste issue is necessary if nuclear energy is to survive. And I believe the nuclear option is almost surely a long-term necessity for our country.

And I face this task with trepidation. The issues are profoundly complex, are social, political, as well as technical, and on many of them I cannot claim firsthand knowledge. All I can offer are impressions of an old-time nuke who many years ago was more involved in the problem of radwaste than he is now.

All three bills aim at putting most of the current efforts at site characterization and indeed geologic disposal on hold. In their stead, long-term, aboveground storage is proposed either in one or more monitored retrievable storage facilities or on reactor sites.

The three most important stated reasons for this shift are, one, 50 year cooled fuel releases less heat than does 10 year old fuel. Ultimate geologic disposal is therefore simpler the longer the fuel is allowed to cool.

Two, if the fuel is kept above ground for 50 years, the reprocessing option is kept open.

And three, adequate site characterization is taking longer than contemplated in NWPA. By storing above ground for 50 years, we give ourselves more time to characterize sites. In particular, we can characterize sites in series rather than in parallel. Should our first choice be a good one, we would save huge sums.

Moreover, we could use this time to investigate other possibilities, such as subseabed disposal, which is mentioned in S. 1266, or use a Pacific atoll, as well as improved packaging. The latter two are not mentioned in the bill.

Let me comment on each of these issues. First, heat production. I give in table 1 the heat produced for various years of storage after fuel has been removed from the reactor. And I only point out that if one waits 50 years instead of 10 years, one reduces the heat load for spent fuel by about a factor of 2.3. For reprocessed high-level waste, HLW, the factor is 2.7.

Now, this does simplify the design and operation of the repository, but it is not absolutely required. Nevertheless, because of this reduced heat load, all countries except the United States have chosen to store above ground about 50 years even as they vigorously pursue geologic disposal.

The second point, reprocessing and recycling. A 1000 megawatt light water reactor using a once-through fuel cycle requires about 150 tons of raw uranium per year. With recycle, the same reactor requires only about 80 tons. That is when it reduces by a factor of two the amount of raw uranium. And if the reactor were redesigned, this number can be reduced further.

Thus, by not reprocessing and recycling wastes uranium, as well as adding to the environmental burden caused by mining and milling of the uranium.

Now, even though recycling saves uranium, it is not economic at present. Irv Spiewak and I estimated that recycling would not be economical unless the price of uranium rose for perhaps three or fourfold over what it is now, up to $150 per kilogram.

Now, the world's reasonably assured uranium resources, plus estimated additional resources at prices less than $130 per kilogram, is enough to fuel without recycle a fleet of 1000 LWRs each producing a million kilowatts for about 50 years. And if you add the speculative resources, such a fleet would be supported for another century.

Thus, recycling is not likely to be economical for at least 50 years and possibly longer. And that, of course, is the reason why people say let's not recycle. Just put the stuff away.

On the other hand, as prudent custodians of our energy future, I would argue that we ought not to forego the recycle option. And this to my mind is a very powerful argument, indeed, in my view a decisive argument favoring long-term, aboveground storage of spent fuel. This argument for deferral of geologic disposal for spent fuel, of course, does not apply to defense HLW, high-level waste.

Third, time for site characterization. If a site is not characterized, we cannot build a repository. And the process is dragging out. Therefore, the fuel, willy-nilly, must remain above ground much longer than contemplated in NWPA unless we can speed up the characterization process.

As I examine these three points, I conclude I am generally in agreement with the intent of these bills to keep spent fuel above ground for 50 years or more, essentially what the Swedes and perhaps the French are doing.

On the other hand, I disagree with those parts of the bills that relieve DOE of any strong incentive to get on with the permanent geologic disposal of nuclear waste. This I cannot accept even though, as I have already pointed out, there is no direct economic or technical incentive to dispose of commercial fuel in less than 50 years from now.

Why then should I continue to advocate getting on with geologic disposal with vigor and dispatch? My reason is simply that the survival of the nuclear option probably depends on demonstration on a large scale of permanent, presumably geologic, disposal of high-level radioactivity. Should the issue drag on for 10, 20, 30 years without resolution, I fear we may lose the nuclear option.

Since there are strong, if not overriding, technical and economic incentives, not to use geologic disposal for commercial fuel for at least 50 years, yet demonstration of such disposal seems to be a necessity for survival of nuclear energy, we are faced with a seeming dilemma. The first consideration calls for keeping the fuel above ground for quite a while; the second seemingly for putting it under ground.

Fortunately, there is a neat way out of this dilemma; namely, to use the first repository, which I hope can be ready by, say, 2000 primarily for glassified defense HLW, high-level waste. Commercial spent fuel would not be placed there for a long time. There are no technical or economic disadvantages to sequestering defense wastes in a geologic repository now, and unlike spent fuel there is no possibility the situation will be different 50 years from now.

Moreover, by explicitly requiring the first commercial repository to receive only defense wastes until, say, 2020, one would be justified in assessing our defense programs for a reasonable share of the cost of the first repository. And I think this is an extremely important point that the committee must consider very seriously—the allocation of some of the costs or a good share of the cost of the defense programs.

The main difficulty which the three proposed bills are seeking to correct is the seeming interminable delay and extraordinary expense of the site characterization process. The bills seek to finesse these difficulties mainly by providing DOE alternatives which I fear will result in even longer delays in getting on with geologic disposal.

I would rather offer a different alternative. Since characterization of three sites in parallel is such an expensive, tedious process, why not streamline the process in particular by having DOE choose a most likely site on the basis of our present knowledge, and going ahead with that site unless and until an insuperable technical difficulty is encountered. Should that happen, we may have lost time, but assuming MRS goes ahead, there will still be places to keep spent fuel above ground.

I do not have any strong views on whether MRS should be a single facility or several facilities. I would point out that MRS as visualized in S. 1266 seems to be much more a place for interim storage rather than a packaging center, as was the original DOE-proposed MRS. Since I advocate 50 years aboveground storage of spent fuel, I agree that MRS should revert to its original role as a storage facility, as well as a repackaging facility.

I strongly support the proposals for massive compensation or rent to the states and localities playing host to both MRS and repository. In fairness, I think the immediate localities should receive a larger share of the rent than the less impacted communities. I believe S. 1266 covers this point.

To summarize my views, I argue, one, spent fuel should remain above ground for 50 years or more.

Two, a geologic repository should be put in place with vigor.

Three, to expedite two, a single site for the repository should be chosen essentially now on the basis of whatever knowledge is now available, but with the understanding that the site should be abandoned if insuperable technical difficulties are encountered.

And four, the first site should be devoted primarily to defense wastes. It would not receive commercial HLW or spent fuel until, say, 2020 or later.

Though I insist that we should get on with the geologic repository, mostly for defense wastes, I do support the effort proposed in S. 1266 to investigate subseabed disposal. I also support research on better packaging methods and on possible use of a Pacific atoll.

Alternatives are important to keep alive for many reasons. The money saved by characterizing sites one by one should be ample to launch substantial investigations of these alternatives.

As for improved packaging, I regard this as sort of hedge against unforeseen difficulties arising in the construction of the first site. As I said in my testimony last April, the better the package, the less is the demand placed on the geology. If the package is totally secure, almost any geology would be acceptable.

Let me conclude on a different note. It seems to me that although good, technical and economic reasons can be adduced for deferring geologic disposal, the underlying, unstated issue is really political. As a country and as a Congress, we seem unwilling to take the ultimate step, and that is to designate a geologic repository, build it, and sequester waste in it.

Perhaps this is inevitable in a Federal, democratic society such as ours. Indeed, I have often feared that the designation of a site would precipitate a constitutional crisis not unlike the Little Rock State-Federal confrontation over school segregation. I suspect the bills being discussed here are aimed, as much as anything, at avoiding such a confrontation.

If this means we cannot have geologic disposal in this country, so be it. Perhaps as is almost implied in S. 1266, we shall then have to maintain MRSs for as long as we exist as a nation.

But I cannot take so pessimistic a view. I hope that with the massive compensation now being proposed, as well as the growing technical sophistication of our waste packaging and disposal methods, we can find places that will welcome a geologic repository.

But this will require great political courage and leadership. Without such courageous leadership, I fear that we shall never dispose of nuclear wastes in geologic strata despite the technical judgment backed by 40 years of study that such disposal poses negligible risks. I hope our politicians at every level can display the political skill and courage needed to face up to the challenge of geologic disposal today rather than bequeathing the problem to further generations.

Thank you, Mr. Chairman

[The prepared statement of Dr. Weinberg follows:]

TESTIMONY ON NUCLEAR WASTE DISPOSAL, S.1141, S.1211, S.1266

Senate Committee on Energy and Natural Resources
July 17, 1987

Alvin M. Weinberg
Institute for Energy Analysis
Oak Ridge Associated Universities
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I have agreed to comment on the proposed amendments to the NWPA, S.1141, S.1211, and S.1266, because I believe some publicly acceptable resolution of the waste issue is necessary if nuclear energy is to survive; and I believe the nuclear option is almost surely a long-term necessity for our country. Yet I face this task with trepidation: the issues are profoundly complex, are social and political as well as technical, and on many of them I cannot claim first hand knowledge. All I can offer are impressions of an old-time nuke who, many years ago, was more involved in the problem of radwaste than he is now.

All three bills aim at putting most of the current efforts at site characterization and, indeed, geologic disposal, on hold. In their stead, long term (~50 years or more) aboveground storage is proposed, either in one or more Monitored Retrievable Storage Facilities, or on reactor sites.

The three most important stated reasons for this shift are:

(1) 50-year cooled fuel releases less heat than does 10-year old fuel; ultimate geologic disposal is simpler the longer the fuel is allowed to cool.

(2) If the fuel is kept aboveground for 50 years, the reprocessing option is kept open.

(3) Adequate site characterization is taking longer than contemplated in NWPA. By storing aboveground for 50 years, we give ourselves more time to characterize sites. In particular, we can characterize sites in series, rather than in parallel; should our first choice be a good one, we would save huge sums. Moreover, we could use this time to investigate other possibilities, such as subseabed (which is mentioned in S.1266); or use of a Pacific atoll, as well as improved packaging, which are not mentioned in the bill.

I comment on each of these issues:

(1) Heat Production. Table 1 gives the heat produced (in watts per metric ton of uranium) for various years of storage after fuel has been removed from the reactor.

Table 1.

Decay Time (years)	Spent Fuel (SF)		High Level Waste (HLW)	
	Watts/MTU	Ratio: 10 y/t	Watts/MTU	Ratio: 10 y/t
10	1100	1.0	930	1.0
20	860	1.3	670	1.4
30	720	1.5	520	1.8
40	540	2.0	430	2.2
50	475	2.3	340	2.7
100	280	3.9	100	9.3

Waiting 50 years instead of 10 years reduces the heat load for spent fuel by a factor of 2.3 for HLW, a factor of 2.7. This simplifies the design and operation of the repository, but is not absolutely required. Nevertheless, because of this reduced heat load, all countries except the U.S. have chosen to store aboveground about 50 years, even as they vigorously pursue geologic disposal.

(2) Reprocessing & Recycling. A 1000 megawatt LWR using a once-through fuel cycle requires 150 tons of raw uranium per year. With recycle, the same LWR requires about 80 tons per year; if the LWR is redesigned, this number can be reduced further, even without full breeding. Thus not reprocessing and recycling wastes uranium, as well as

adding to the environmental burden caused by mining and milling of uranium.

Even though recycling saves uranium, it is not economic at present. I. Spiewak and I have estimated that recycling would not be economical unless the price of uranium rose to $150/kg. The world's reasonably assured uranium resources, plus estimated additional resources at prices less than $130/kg is enough to fuel without recycle a fleet of 1000 LWRs, each producing a million kilowatts, for about 50 years. If the speculative resources are added, such a fleet would be supported for another century. Thus recycling is not likely to be economical for at least 50 years, and possibly longer. On the other hand, as prudent custodians of our energy future, I would argue that we ought not forego the recycle option. This is a very powerful argument, indeed in my view, a decisive argument, favoring long-term aboveground storage of spent fuel. This argument for deferral of geologic disposal of course does not apply to the defense HLW.

(3) Time for Site Characterization. If a site is not characterized, we cannot build a repository--and this process is dragging out. Therefore the fuel, willy-nilly, must remain aboveground, much longer than contemplated in NWPA, unless we can speed up the characterization process.

As I examine these three points, I conclude that I am generally in agreement with the intent of these bills to keep spent fuel aboveground for 50 years or more. On the other hand I disagree with those parts of the bills that relieve DOE of any strong incentive to get on with the permanent, geologic disposal of nuclear wastes. This I cannot accept, even though, as I have already pointed out, there is no direct economic or technical incentive to dispose of commercial fuel in less than 50 years from now.

Why then should I continue to advocate getting on with geologic disposal with vigor and dispatch? My reason is simply that the survival of the nuclear option probably depends on demonstration on a large scale of permanent, presumably geologic, disposal of high level radioactivity. Should the issue drag on for 10, 20, 30 years without resoluion, I fear we may lose the nuclear option.

Since there are strong if not overriding technical and economic incentives not to use geologic disposal for commercial fuel for at least

50 years, yet demonstration of such disposal seems to be a necessity for survival of nuclear energy, we are faced with a seeming dilemma: the first consideration calls for keeping fuel aboveground, the second, seemingly, for putting it underground. Fortunately, there is a neat way out of this dilemma--namely to use the first repository, which I hope can be ready by, say, 2000, primarily for glassified defense HLW; commercial spent fuel would not be placed there for a long time. There are no technical or economic disadvantages to sequestering defense HLW in a geologic repository now; and unlike spent fuel, there is no possibility that the situation will be different 50 years from now. Moreover, by explicitly requiring the first commercial repository to receive only defense waste until, say, 2020, one would be justified in assessing our defense programs for a reasonable share of the cost of the first repository.

The main difficulty which the 3 proposed bills are seeking to correct is the seeming interminable delay and extraordinary expense of the site characterization process. The bills seek to finesse these difficulties mainly by providing DOE alternatives which I fear will result in even longer delays in getting on with geologic disposal.

I would offer a rather different alternative: since characterization of 3 sites in parallel is such an expensive, tedious process, why not streamline the process--in particular, by having DOE choose a "most likely" site on the basis of our present knowledge, and going ahead with that site unless and until an insuperable technical difficulty is encountered. Should that happen, we may have lost time--but, assuming MRS goes ahead, there will still be places to keep spent fuel aboveground.

I do not have any strong views on whether MRS should be a single facility or several facilities. I would point out that MRS as visualized in S.1266 seems to be much more a place for interim storage rather than a packaging center as was the original DOE-proposed MRS. Since I advocate 50 years aboveground storage of spent fuel, I agree that MRS should revert to its original role as a storage facility, as well as a repackaging facility.

I strongly support the proposals for massive compensation or rent to the states and localities playing host to both MRS and repository. In fairness, I think the immediate localities should receive a larger share of the rent than the less impacted communities, and I believe S.1266 covers this point.

To summarize my views, I argue

(1) Spent fuel should remain aboveground for 50 years or more.
(2) A geologic repository should be put in place with vigor.
(3) To expedite (2), a single site for the repository should be chosen, essentially now, on the basis of whatever knowledge is now available, but with the understanding that the site would be abandoned if insuperable technical difficulties are encountered.
(4) The first site would be devoted primarily to defense wastes; it would not receive commercial HLW until 2020 or later.

Though I insist that we should get on with the geologic repository, mostly for defense wastes, I support the effort proposed in S.1266 to investigate sub-seabed disposal; I also support research on better packaging methods, and on possible use of a Pacific atoll. Alternatives are important to keep alive for many reasons. The money saved by characterizing sites one-by-one should be ample to launch substantial investigations of these alternatives.

As for improved packaging, I regard this as a sort of hedge against unforeseen difficulties arising in the construction of the 1st site. As I said in my testimony last April, the better the package, the less is the demand placed on the geology. If the package is totally secure, almost any geology would be acceptable.

I conclude on a different note. It seems to me that, although good technical and economic reasons can be adduced for deferring geologic disposal, the underlying, unstated issue is really political. As a country, and as a Congress, we seem unwilling to take the ultimate step--and that is to designate a geologic repository, build it, and sequester waste in it.

Perhaps this is inevitable in a Federal, democratic society such as ours. Indeed, I have often feared that the designation of a site would precipitate a Constitutional crisis, not unlike the Little Rock State-Federal confrontation. I suspect the bills being discussed here are aimed, as much as anything, at avoiding such a confrontation.

If this means we cannot have geologic disposal in this country, so be it. Perhaps, as is almost implied in S.1266, we shall then have to maintain MRSs for as long as we exist as a nation.

But I cannot take so pessimistic a view. I hope that, with the massive compensation now being proposed, as well as the growing technical sophistication of our waste packaging and disposal methods, we can find places that will welcome a geologic repository. But this will require great political courage and leadership. Without such courageous leadership, I fear that we shall never dispose of nuclear wastes in geologic strata, despite the technical judgment, backed by 40 years of study, that such disposal poses negligible risks. I hope our politicians at every level can display the political skill and courage needed to face up to the challenge of geologic disposal today rather than bequeathing it to future generations.

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Senator EVANS. Thank you very much, Dr. Weinberg.
Mr. Burstein.

STATEMENT OF SOL BURSTEIN, VICE CHAIRMAN, WISCONSIN ELECTRIC POWER CO.

Mr. BURSTEIN. Thank you, sir. I appreciate and thank you for the opportunity to appear on behalf of the nuclear industry to discuss the Nation's nuclear waste management program. I request that my full statement be included in the record of this hearing, and I will briefly summarize it at this time.

The nuclear energy industry is in agreement on the direction that the Nation's nuclear waste program must take. We are unanimous in our basic support for the implementation of the Nuclear Waste Policy Act of 1982.

In that act this Nation reaffirmed its responsibility and commitment to provide safe and secure disposal of the nuclear waste we are creating and not leave this task to future generations. Congress crafted a unique bargain that those generating the waste would pay for the cost of disposal in exchange for a firm commitment that DOE would do so on a specific schedule.

The first priority of Congress should be to carry through Nuclear Waste Policy Act implementation with waste disposal provided in geological repositories. The electric utilities and the electricity consumers are living up to their obligations under this bargain crafted under the Nuclear Waste Policy Act. We expect all other parties to do the same.

Perhaps the greatest challenge to ever developing any waste disposal system is the perception by some that a delay in the Nuclear Waste Policy Act implementation is acceptable and even desirable if it results in a better repository system. The program will continue to be paralyzed by the quest for a better solution even though the one at hand is entirely appropriate.

To meet this challenge, we must, first, characterize the sites that have been approved by the President for detailed study as the first repository. This would be to everyone's advantage so we can decide if these sites can serve as a repository. Congress must appropriate the necessary monies that are available in the nuclear waste fund and support exploratory shaft drilling.

While the act calls for the characterization of three sites, there is another way to proceed. The recently introduced S. 1481, Nuclear Waste Policy Act amendments of 1987, provides a reasonable way to permit the process to move forward. Our industry supports its enactment to simplify and enhance the NWPA process. However, until a modification such as embodied in this legislation is enacted, DOE must be instructed to carry out the program as intended in the original act.

Second, we must construct and operate a single monitored retrievable storage facility. An integral MRS would provide the program with flexibility, early resolution of several issues and a reasonable time schedule for fulfilling our obligations under the act. Congress should authorize the MRS with complete and specific siting guidance, including an appropriate incentives package for the host state, the Indian tribes and local communities involved, and not link use of the MRS to the receipt of a first repository construction authorization.

Third, we need to provide a reasonable second repository program that meets the needs of the high-level radioactive waste disposal program. It should be clear to all parties by now that the 1986 actions by DOE on the second repository program did not resolve but may have confused this issue. We urge that Congress act to accept DOE's proposed resolution of that in S. 1481 and put the second repository issue behind us.

Fourth, require that the national defense programs pay their fair and equitable share of the nuclear waste disposal program.

And fifth, provide broader incentives to the host states and localities of nuclear waste facilities to assuage any disadvantage that may accompany the hosting of such facilities. S. 1481 contains provisions that would greatly enhance the ability for all parties to work together such that the Nuclear Waste Policy Act can live up to its promise.

As you recall, Mr. Chairman, Senate Bill 1211, the Nuclear Waste Reprocessing Act, reminds us that reprocessing of spent fuel was the planned approach for commercial nuclear programs as they were conceived by electric utilities. Many utilities, including my own, signed contracts with potential reprocessors in the late 1960s and early 1970s with the full intention of recovering the energy values from spent reactor fuel as a means of providing an assured future energy resource.

Three companies invested a total of several hundred millions of dollars in facilities to provide reprocessing services. All of these attempts to reprocess commercial spent fuel were aborted for institutional and economic reasons. Of course, the military nuclear program must reprocess for reasons completely apart from waste disposal.

Several very important and thorough studies have been performed on the advantages and feasibility of reprocessing. Review of the extensive documentation on the value of reprocessing indicates that for the foreseeable future the overall advantage of direct disposal of spent fuel without reprocessing is both safe and the lower cost way to proceed.

France, indeed, reprocesses spent fuel, and West Germany and Japan have plants to do so. That these countries are or will reprocess does not provide reasonable justification to require reprocessing prior to the disposal in the United States. The Congress should not delay the ongoing program to study again reprocessing as offered in S. 1211.

S. 1266 deals with high-level radioactive waste storage. Utilities have supported the authorization of a single MRS as an integral part of the overall nuclear waste program to permit advantages of preparing the waste for disposal at a location that is central to the Nation's nuclear energy plants.

A single MRS as envisioned by the Nuclear Waste Policy Act is a justifiable part of the program. However, more than one MRS is not needed, and the added cost of such an approach seems to be unwarranted.

The Federal Government has a commitment to start receiving spent fuel from electric utilities by 1998. This is a key aspect of the overall bargain established by Congress with us in the Nuclear Waste Policy Act. It appears that the multiple MRS concept is being offered to serve both a long-term storage need and a means to fulfill the contractual commitments to the utilities.

During the debate in developing the NWPA, utilities originally wanted to have away-from-reactor storage facilities. And the arguments used by the electric utilities at that time would be appropriate now to favor multiple MRSs. However, the Congress rejected that approach in favor of proceeding with nuclear waste in geologic repositories because storage only would not fulfill the obligations that this generation has to dispose of its nuclear waste.

We support the MRS not as a storage facility, but as a means to begin the process of disposal. The MRS should be an integral part of the overall program to provide a needed flexibility and make for early progress toward disposal. The electric utilities now urge the Federal Government to proceed with waste disposal as called for in the act and to include a single MRS.

Alternative waste disposal technologies, including deep seabed, were studied and documented by DOE and its predecessor agencies prior to the 1982 action by Congress that selected geologic disposal as the preferred technology need not be repeated again.

Mr. Chairman, the electric utilities have collected $3 billion from its customers in support of this program. I think we owe them the obligation of carrying through with that bargain that we made earlier. We have studied the four bills that are the specific subject of this hearing. The sponsors of that legislation are certainly to be commended for their concerns with the nuclear waste program and their efforts to seek improvement.

Unfortunately, as we look at them, we find for the reasons set out in our full testimony that the bills would not get the Nation any closer to the goal of accomplishing nuclear waste disposal. We recommend that Congress not adopt these proposals.

Thank you for this opportunity to present our views. We would be pleased to respond to any questions you may have.

[The prepared statement of Mr. Burstein follows:]

TESTIMONY OF
SOL BURSTEIN, VICE CHAIRMAN
WISCONSIN ELECTRIC POWER COMPANY
ON BEHALF OF
EDISON ELECTRIC INSTITUTE
AMERICAN NUCLEAR ENERGY COUNCIL
UTILITY NUCLEAR WASTE MANAGEMENT GROUP
ELECTRIC UTILITY COMPANIES' NUCLEAR TRANSPORTATION GROUP
ATOMIC INDUSTRIAL FORUM
ON THE
NUCLEAR WASTE PROGRAM
AND PROPOSED LEGISLATION
S. 1007, S. 1141, S. 1211, S. 1266
BEFORE THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
JULY 17, 1987

Mr. Chairman, Committee members, good morning - thank you for the opportunity to appear on behalf of the nuclear energy industry to discuss the nation's nuclear waste management program. My name is Sol Burstein. I am Vice Chairman of Wisconsin Electric Power Company, the owner and operator of the Point Beach Nuclear Plant. This is a two-unit nuclear generating station with just under 1000 Mwe capacity. These units provide nearly 40 percent of our electricity production. My statement this morning is provided on behalf of the Edison Electric Institute, American Nuclear Energy Council, Utility Nuclear Waste Management Group, Electric Utility Companies' Nuclear Transportation Group and Atomic Industrial Forum. I am sure you are familiar with these groups, but for the record, a description of each is attached.

The nuclear energy industry is in agreement on the direction that the nation's nuclear waste program must take. We are unanimious in our basic support for the implementation of the Nuclear Waste Policy Act of 1982 (NWPA). The 100th Congress, especially this Committee, has studied the DOE NWPA implementation in great depth. Many Members of Congress have offered responsible initiatives to correct the present unsatisfactory situation and to improve the waste disposal effort.

I am sure that all of us believe that with the passage of the NWPA we had long last decided to live up to our obligation to provide safe and secure disposal of the nuclear waste we are creating and not leave this task to future generations. The NWPA struck a bargain. Those who produce spent nuclear fuel would pay the costs of its disposal in exchange for a firm commitment that DOE would dispose of these materials starting no later than January 31, 1998. During the original consideration of the NWPA, the industry recognized that alternative technologies, such as reprocessing and centralized storage-only spent fuel management, which were desirable on their own merits, were not central to high-level radioactive waste disposal. Since enactment of the NWPA we have been consistent in our support for developing the disposal system. We reiterate that policy today. The first priority of Congress should be to carry through NWPA implementation with waste disposal provided in a deep geologic repository. The electric utilities and the electricity consumers are living up to their obligations under the NWPA. We expect all other parties to do the same. Congress and DOE must keep faith with the NWPA. Perhaps the greatest challenge to ever developing any waste disposal system is the perception by some that a delay in NWPA implementation is acceptable, and even desirable, if it results in a better repository system. The program will always be subjected to distraction by the quest for a better solution, even though the one at hand is entirely appropriate. To meet this challenge, we must:

1. Characterize the sites that have been approved by the President for detailed study as the first repository. The potential host states and Indian Tribes are raising significant questions about the suitability of the first repository sites while, at the same time, proposing that site characterization be delayed. It is to everyone's advantage to answer these questions so we can decide if these sites can serve as a repository. We would certainly like to know if the funds are being invested in the right locations. The only way to answer these questions fully is to characterize the sites; after all, that is the purpose of site characterization as envisioned by the NWPA. This must include the drilling of the exploratory shafts to study the rock body at the horizon of the potential repository. Both the National Academy of Sciences and the Nuclear Regulatory Commission have testified before this Committee that there is no reason to disqualify, at this time, any of the three potential first repository sites and that characterization should, including exploratory shaft drilling, proceed to answer the questions raised about each location. To do this, Congress must appropriate the necessary monies that are available in the Nuclear Waste Fund and support exploratory shaft drilling.

   While the NWPA calls for the characterization of three sites, there is another way to proceed. The recently introduced S. 1481, Nuclear Waste Policy Act Amendments Act of 1987, provides a reasonable way to permit the process to move forward. Congress would require DOE to proceed sequentially, by January 1, 1989, with the three sites that have been selected. DOE would characterize one site at depth and move to the next site only if the previous one was determined to be inadequate for a repository. Limited work would continue on the surface of the alternate sites not being explored to depth. Once a site proves to be adequate, the work at the other sites would be discontinued and DOE would proceed with the single site. Congress would declare that the alternative site requirements of NEPA, 10 CFR Part

60, etc. have been satisfied by the activities to date. A substantial incentives package would be provided to the host state, Indian Tribe and local jurisdiction of the site being characterized at depth. We believe that S. 1481 has tremendous merit, but would be improved if Congress, rather than DOE, would specify the sequence for the three sites to be characterized.

S. 1481 has much to commend it and our industry supports its enactment to simplify and enhance the NWPA process. However, we must not lose sight of the fact that the NWPA is already on the books and it is perfectly adequate to do the job. DOE must be instructed to continue with the present program until a modification, such as S. 1481, is enacted.

2. Construct and operate a single monitored retrievable storage facility (MRS). As an integral part of the waste disposal program the MRS will perform the essential, early steps towards waste disposal that can be performed in parallel with the selection of the first repository. The functions envisioned to be performed at the MRS cannot be performed as efficiently and effectively at reactor sites and should be carried out at some central location whether at the repository or MRS. However, doing so at the MRS will provide the program with flexibility, early resolution of important issues and a reasonable time schedule for fulfilling our obligation to dispose of our nuclear waste safely. The MRS would be a waste receiving and processing facility with temporary storage, but is not intended nor designed as a facility for waste disposal. To accomplish this, Congress should authorize the MRS and include a subsantial incentives package for the host state, Indian Tribe and local communities. S. 1481 accomplishes this and provides specific and complete direction for siting the MRS. Oak Ridge, Tennessee is named as the site with a provision for alternative sites to be volunteered by January 1, 1989. However, Congress should not link use of the MRS to receipt of a first repository construction authorization. Doing so would make the start-up of the MRS less certain, because it would await not only its own licensing, but also that of the first repository before it can be used. While the MRS would retain much of its strategic value to the disposal system with the linkage, it will not be as useful. Furthermore, the linkage will not convince the MRS host state that the MRS will not become the permanent spent fuel resting place. Only an on-going repository program can provide that assurance. Congress should both authorize the MRS and create the conditions the will convince the MRS host state that the spent fuel will not remain at the MRS; S. 1481 provides a mechanism to achieve these dual goals.

3. Provide a reasonable second repository program that meets the needs of the high-level radioactive waste disposal

program. It should be clear to all parties by now that the 1986 actions by DOE on the second repository program did not resolve this matter at all. These actions helped create an impasse over the continuation of NWPA implementation that, obviously, still exists. We have been asking Congress and the Administration to resolve the differences over plans for the second repository. This plea has been in our testimony before this and other Committees, and in our formal comments on the Draft Mission Plan Amendment. Perhaps in the rush to vilify DOE, no one has noticed that they have responded to everyone's complaints on the plans for the second repository about as well as could be expected. In the recently submitted Mission Plan Amendment, DOE has laid out a plan to return anew to the second repository site-specific program at a future time. This appears consistent with the actual need for a second repository. S. 1481 proposes, as an alternate resolution to this impasse, to study the need for the second repository. Either resolution, if acceptable to Congress, would be an appropriate way to address the second repository issue. We urge that Congress act to put the second repository issue behind us so the NWPA program can move forward.

4. Require the national defense programs to pay their fair and equitable share of the nuclear waste disposal program. The President made the decision, called for in the NWPA, to include defense wastes in the same repository as commercial nuclear wastes. Electric utilities have collected from electricity customers and paid $3 billion into the Nuclear Waste Fund. To date, the defense side, however, has not paid a penny of its fair share of the costs.

5. Provide broader incentives to the host states and localities of nuclear waste facilities to assuage any disadvantages that may accompany the hosting of such facilities. However, everyone must recognize that money will not be enough. S. 1481 envisions a partnership between DOE and a state or Indian Tribe and proposes to enforce the partnership by limiting the ability of parties to terminate a benefits agreement. It seems clear to us that a state or Indian Tribe would become a willing partner only if it were convinced that DOE would treat their concerns with respect and involve them in the process. The sword of partnership, however, cuts both ways. DOE must be convinced that the state or Indian Tribe will participate in good faith and not simply demand that DOE abandon the site. We all have to work together if the NWPA program is to live up to its promise. We have seen and participated in several, albeit minor, events where the disparate parties have been able to come to a working agreement. It can be done, but we have to decide that we will do it and then continue to work at the relationship. S. 1481 will greatly enhance the ability for all parties to accomplish this goal.

CONGRESSIONAL DIRECTION

Congress provided sound and specific direction for the disposal of nuclear waste with the passage of the Nuclear Waste Policy Act of 1982. After years of studying a number of alternative disposal techniques, Congress determined that disposal would be in deep geologic repositories. Since it was anticipated that no state, Indian Tribe or locality would quickly volunteer to host a repository, Congress decided to give those parties a constructive oversight role. The NWPA provides the opportunity for the potential host states and Indian Tribes to participate in the activity and often times object to the decisions. Few surprises have occurred in the responses from the potential host areas during the past four and one half years of implementation. The potential host states have been very effectively represented by their appointed and elected officials, both in Congress and in the courts.

Congress now must accept the responsibility to provide the means to move the program forward under the established ground rules. In passing the NWPA, Congress defined the road map for developing the high-level radioactive waste disposal system. While each party desired greater advantage for their particular interest, the NWPA provided an effective means for the various interests in the nation to be satisfied while the difficult task of providing safe and secure disposal of nuclear wastes is achieved. The NWPA continues to stand as a landmark compromise of competing interests. While the NWPA may need to be augumented to provide broader incentives for the host states, Indian Tribes and communities, the basic integrity of the NWPA must be retained. Congress must foster its implementation and not divert this vital program from achieving its important goals.

The electric utilities have always taken a great interest in the high-level radioactive waste disposal program from well before NWPA enactment. Since 1983, we have been very active in providing assistance and criticism to DOE in its implementation of the NWPA. The industry, through the Utility Nuclear Waste Management Group and the Electric Utility Companies' Nuclear Transportation Group, has been interacting with the DOE in an attempt to improve the program. We are gratified that DOE has accepted some of our suggestions provided in formal comments and in informal interactions. Based on our input, DOE has incorporated changes to the NWPA program in project management, financial management, licensing and quality assurance. With regard to recognizing the 1998 obligation, defense waste cost sharing, and state and Indian Tribe interactions, DOE, however, needs to do better. We want to be helpful to the process, while, at the same time, protecting the consumer's and our interests.

As part of our efforts, we have reviewed the first repository site selection decisions with our own independent experts. While we have not written our own report on the subject, we have reviewed others' reports. We have concluded that DOE's site selection process was not perfect, but it was adequate. DOE was not required, at this stage, to pick the site of the final repository, but to identify three sites that appear to be worthwhile investigating. The final selection is to be made after detailed investigations at depth have been conducted and the information analyzed against the regulatory requirements. It is incongruous to raise questions about a site's applicabilty, while at the same time not permitting DOE to characterize the site to obtain the answers.

PROPOSED LEGISLATION

S. 1007 (Amendment to § 116 of PL 97-425) - This bill seeks to expand the definition of affected states for the implementation of the NWPA. An argument can be made that all 50 states are touched in some way by NWPA activities. Some have nuclear energy plants, some have highways or railways that the nuclear wastes will traverse, a limited few are potential host states for waste facilities or are adjacent to potential hosts states, and some host defense nuclear activities or are home to military bases and ports that have nuclear missions. However, the NWPA strikes a reasonable balance by defining the affected states and Indian Tribes and their role in a special way. This provision of the NWPA should be retained. The arguments provided in S. 1007 do not justify the expansion of the definition of affected states. Such an action would only complicate further the very difficult task at hand. We recommend that Congress not change the NWPA to incorporate features offered in S. 1007.

S. 1141, Nuclear Energy Waste Policy Act of 1987 - Long-term storage of spent fuel and nuclear waste was one of the options considered seriously during the development of the NWPA. Such an option had merit at that time and it has merit now. However, in the development by Congress of the difficult compromise the NWPA represents, this long-term storage option was rejected for several justifiable reasons. Thermal and radiological cooling occurs with time and long-term storage offers an advantage to some extent. However, proceeding with the present program will probably result in the spent fuel or nuclear waste being at least 20 years old before it is placed in the repository. Essentially all of the technical advantages of long-term storage before disposal are achieved with this 20 year cooling period. Delaying the work to provide limited additional cooling of the waste that would occur even if the period was more than doubled is simply not justified. The recommended 50 year storage is not warranted and this change to the NWPA should not be made.

S. 1211 (Nuclear Waste Reprocessing Study Act of 1987) - Reprocessing of spent fuel was the planned approach for commercial nuclear programs as they were conceived by electric utilities. Many utilities signed contracts with potential reprocessors in the late 1960s and early 1970s with the full intention of recovering the energy values from spent reactor fuel as a means of providing an assured future energy resource. Three companies invested a total of several hundred millions of dollars in facilities to provide reprocessing services. All of these attempts to reprocess commercial spent fuel were aborted for institutional and economic reasons. Of course, the military nuclear program must reprocess for reasons completely apart from waste disposal.

Several very important and thorough studies have been performed on the advantages and feasibility of reprocessing. Review of the extensive documentation on the value of reprocessing indicates that, for the foreseeable future, the overall advantage of direct disposal of spent fuel without reprocessing is both safe and the lower cost way to proceed. Yes, France reprocesses spent fuel and West Germany and Japan have plans to do so. That these countries are, or will, reprocess does not provide reasonable justification to require reprocessing prior to disposal in the U.S. The Congress should not delay the on-going program to study again reprocessing as offered in S. 1211.

S. 1266, High-Level Radioactive Waste Storage Act of 1987 - Utilities support the authorization of a single MRS as an integral part of the overall nuclear waste program to permit advantages of preparing the waste for disposal at a location that is central to the nation's nuclear energy plants. A single MRS, as envisioned by the NWPA, is a justifiable part of the program. However, more than one MRS is not needed and the added cost of such an approach is unwarranted. The Federal Government has a commitment to start receiving spent fuel from electric utilities in 1998. This is a key aspect of the overall bargain established by Congress in the NWPA. It appears that the multiple MRS concept is being offered to serve both a long-term storage need and a means to fulfill the contractual commitments to the utilities. During the debate in developing the NWPA, utilities originally wanted to have away-from-reactor storage facilities and the arguments used by electric utilities at that time would be appropriate now to favor multiple MRSs. However, the Congress rejected that approach in favor of proceeding with waste disposal in geologic repositories, because storage-only would not fulfill the obligation that this generation has to dispose of its nuclear waste. We support the MRS, not as a storage facility, but as a means to begin the process of disposal. The MRS would be an integral part of the overall program to provide needed flexibility and make for early progress towards disposal. The electric utilities now urge the Federal Government to proceed with waste disposal, as called for in the NWPA, and to include a single MRS. Alternative waste disposal technologies, including deep seabed, were studied and documented by DOE (and its predecessor agencies) prior to the 1982 action by Congress that selected geologic disposal as the preferred technology. Congress was fully aware of the various options when it selected geologic disposal. It may be desirable for the nation to sponsor a limited amount of generic research on deep seabed disposal, as well as other alternatives, as a part of overall government research. However, Congress wisely limited the use of funds collected from electricity consumers to specific work related to geologic repositories.

SUMMARY

All the inputs that the 100th Congress has received further emphasize the wisdom of the 97th Congress in providing a road map for a responsible way to fulfill the national need for safe and secure nuclear waste disposal now and not put it off expecting future generations to provide the capability. We continue to urge Congress to keep the bargain made in the NWPA, appropriate the available funds to permit timely site characterization for the first repository, including the drilling of exploratory shafts so the rock body can be evaluated at the repository depth, to authorize a single MRS with specific direction for siting the facility, to require DOE to proceed with an appropriate level of effort for a second repository, to offer broader incentives for host states, Indian Tribes and communities, and to require the defense programs to pay their fair share for waste disposal.

It all boils down to the questions of when and how the nation will dispose of its nuclear waste. The American people want us to proceed with establishment of a nuclear waste disposal system. Electric utilities will continue to play their role under the NWPA as long as everyone else plays theirs. We all must work together to take those actions that make sense to move the program forward. Enacting S. 1481 is one such action.

Mr. Chairman, thank you for the opportunity to present the views of the nuclear industry. I would be pleased to answer your questions.

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ATTACHEMENT

The Edison Electric Institute (EEI) is the association of investor-owned electric companies. Its members serve approximately 73 percent of ultimate electric customers in the Nation. EEI's membership includes the majority of DOE's nuclear waste services customers.

The American Nuclear Energy Council (ANEC) represents over 100 organizations having an interest in nuclear power, including investor, public and cooperatively-owned utilities, manufacturers, architect-engineers and various firms in the nuclear fuel cycle.

The Utility Nuclear Waste Management Group (UNWMG) is a specific activity that is funded by 45 utilities with nuclear programs, including EEI member companies, public utilities and cooperatively-owned utilities. Its primary purpose is to promote the implementation of the Nuclear Waste Policy Act and to assist in the resolution of spent fuel storage and nuclear waste disposal issues.

The Electric Utility Companies' Nuclear Transportation Group (EUCNTG) represents 33 investor owned and publicly owned utilities. One of EUCNTG's primary objectives is to promote successful implementation of transportation-related provisions of the NWPA.

The Atomic Industrial Forum (AIF) is an association dedicated to the development of the peaceful uses of atomic energy. Its approximately 400 U. S. members include electric utilities, which are funding activities mandated under the NWPA, as well as manufacturers, architect-engineers, constructors and consultants playing important roles in its implementation.

Senator Evans. Thank you very much.

Mr. Hancock.

STATEMENT OF NOLAN W. HANCOCK, CITIZENSHIP-LEGISLATIVE DIRECTOR, OIL, CHEMICAL AND ATOMIC WORKERS INTERNATIONAL UNION

Mr. Hancock. Thank you, Mr. Chairman. I welcome the opportunity to testify as to what to do with high-level radioactive waste and spent nuclear fuel.

The Oil, Chemical and Atomic Workers International is the primary representative for workers employed in energy or fuel producing industries, with the exception of coal, with a total membership exceeding 110,000 members. Our union represents several thousand workers in the nuclear industry.

OCAW is particularly pleased that the Senate Energy and Natural Resource Committee is undertaking to resolve the many problems facing the nuclear electricity generating industry. This industry will soon produce 20 percent of our Nation's electricity. We recognize the vital role that nuclear power must play in maintaining our Nation's energy independence. We are proud of the contributions our members make in producing this important product.

We recognize that the nuclear industry has certain difficult questions to answer. The amount of DOE's enrichment debt, the demise of the uranium producing industry and the question of mill tailings reclamation create uncertainties in the front end of the nuclear fuel cycle. Fortunately, legislation has been introduced and is now pending before this committee which the OCAW firmly believes will cure these problems.

The back end of the nuclear fuel cycle is also of critical importance to our Nation. We must resolve the question of what to do with high-level radioactive waste and spent nuclear fuel. We urge the committee and Congress to continue its efforts to examine and remedy the concerns of the entire nuclear fuel cycle as quickly and prudently as possible.

OCAW was a supporter of the Nuclear Waste Policy Act of 1982. This act recognized the vital importance of addressing the issue as to what to do with nuclear waste. We still support this act, but in the event it is impossible to complete this program on a timely basis, close examination of the legislation such as those before the committee today is appropriate. Our major concern is that the issue of how to dispose of high-level nuclear waste be addressed and finalized as soon as reasonably possible.

The consumption of nuclear fuel by nuclear utilities is at an all-time high. This is true not only in the United States but worldwide. Despite this fact, the commercial nuclear industry is beset by problems and is not growing. Many jobs and much of our Nation's energy independence are directly related to our ability to produce cheap and safe electricity. We believe nuclear power can do just that.

If Congress allows this industry to decline, it will have a terrible impact on our members and the communities that have long supported the facilities that make up the nuclear fuel industry. The membership of OCAW is a group of highly skilled workers. It would be a devastating blow to our economy to lose these workers and those skills to other forms of employment.

The membership of OCAW is highly qualified to be involved in the physical handling of high-level radioactive waste. Our workers have a great deal of experience in working with nuclear fuel in its various forms, and they understand that nuclear fuel can be used safely.

We urge Congress to act on the question of nuclear waste disposal on a reasonably expedited manner so our skilled workers will be available to carry out the program mandated by legislation.

The OCAW agrees with the ideas put forth by Senator Evans and Senator Hecht that a long, hard look should be taken at the reprocessing of spent nuclear fuel. The known reserves of uranium are not inexhaustible. Because we believe nuclear energy will continue to play a long-term role in the supply of electricity to our Nation's citizens and businesses, it makes good sense to explore the reuse of this valuable fuel. We believe future generations would think of this as a worthwhile effort.

From my review of S. 1266, I agree with Senator Evans' proposition that if his legislation was adopted, each region of the country which benefits from the generation of nuclear power should equitably bear the full costs of interim storage and long-term disposal of spent nuclear fuel. I think that regional storage facilities would prompt this idea. I believe the aspect of this proposal to move this material to monitored storage sites rather than leave them the material at the site at which it was created makes good sense.

If workers who have previously dealt with this material are used at such monitored sites, they would be much more skilled in the handling of such materials than personnel at a nuclear utility. This skilled ability would, in my opinion, outweigh any possible problems in the transportation of this material to the monitored storage sites.

In closing, I would reiterate that OCAW supports the efforts of the Senate Energy Committee to address the key issues facing the nuclear fuel industry. Many jobs held by our membership are at stake.

Further, without clean and inexpensive electricity, our Nation's economy and its workers will be hard-pressed to compete with foreign nations.

I hope that hearings like this one today will result in a continued enhancement of the positive effects of a sound nuclear power industry.

Thank you.

[The prepared statement of Mr. Hancock follows:]

TESTIMONY OF

NOLAN W. HANCOCK

ON BEHALF OF THE

OIL, CHEMICAL AND ATOMIC WORKERS
INTERNATIONAL UNION

BEFORE THE

SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

ON THE

NUCLEAR WASTE PROGRAM

JULY 17, 1987

Mr. Chairman and members of the Committee, my name is Nolan W. Hancock. I am the Citizenship-Legislative Director of the Oil, Chemical and Atomic Workers International Union. I welcome the opportunity to testify on behalf of the OCAW concerning the need to resolve the question as to what to do with high-level radioactive waste and spent nuclear fuel.

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The OCAW agrees with the ideas put forth by Senators Evans and Hecht that a long hard look should be taken at the reprocessing of spent nuclear fuel. The known reserves of uranium are not inexhaustible. Because we believe nuclear energy will continue to play a long-term role in the supply of electricity to our nation's citizens and businesses it make good sense to explore the reuse of this valuable fuel. We believe future generations would think of this as a worthwhile effort.

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In closing, I would reiterate that the OCAW supports the efforts of the Senate Energy Committee to address the key issues facing the nuclear fuel industry. Many jobs held by our membership are at stake. Further, without clean and inexpensive electricity, our nation's economy and its workers will be hard-pressed to compete with foreign nations. I hope that hearings like this one today will result in a continued enhancement of the positive effects of sound nuclear power industry.

Senator **Evans**. Thank you very much, Mr. Hancock, and my thanks to the entire panel.

Let me begin with questions of Dr. Weinberg. I was interested first in the table you had on decay time. I have asked this question several times of previous witnesses, and we have had partial responses. This is the first time I have really seen as simply and as explicitly this particular table set forth.

But let me follow through on that. As we know, the current Nuclear Waste Policy Act puts a limit of 70,000 tons on each deep geologic repository. It is my understanding from previous testimony also that the design at least contemplated was for 10 year old fuel. Now, we all understand that there is a lot of fuel that is sitting out there in various places that is a lot older than 10 years, and that the actual age as it goes into the repository, even if it was built under the fastest possible timetable, would be older than 10 years for a time. And as we got into the regular delivery of spent fuel to a repository in being, it would probably come down to the 10 year period.

Having said all of that, tell me. How do we relate the amount of heat? It isn't the tonnage there. If we had 70,000 tons of pure dirt, nobody would worry very much about where you put it. It is the radioactivity and the heat load in that material that is of concern to people.

Is it accurate to compare, for instance, a 10 year old fuel with a 50 year old fuel, as you do in this table just taking spent fuel rather than the high-level waste? And 2.3 to 1—can you translate that simply into saying that it is 2.3 times 70,000 tons, which is 161,000 tons of 50 year old fuel, would have approximately the same residual radioactivity and heat as 70,000 tons of 10 year old fuel?

Dr. **Weinberg**. That is absolutely correct. However, my understanding of the matter is that the 70,000 tons limit was not based on the total heat load. I am not absolutely sure of that, but my impression is that it was a rather arbitrary number, shall I say, politically decided upon.

But perhaps Sol Burstein can clarify that. Do you remember if the 70,000 tons had anything to do with the total heat load? I do not think it did, Sol.

Mr. **Burstein**. I agree. It did not, sir. I think again it was part of the very substantial balance and bargain that was struck since it was determined that that would accommodate the needs of the first repository before the second one might be required, and the timetable for those was the primary guide rather than anything to do with levels of radioactivity or levels of heat.

Senator **Evans**. I am quite aware of that. What I am trying to get at is, first, the question of whether there is that equivalency in terms of——

Dr. **Weinberg**. In terms of total heat, that's correct.

Senator **Evans** [continuing]. What you are going to put in the ground.

Dr. **Weinberg**. Yes.

Senator **Evans**. And if you can make that simple of a characterization of it, then that's fine.

What we would say in essence is that wherever we were contemplating placing 70,000 tons of spent fuel at this design age of 10 years, there would be no more radioactivity and no more heat with 160,000 tons of 50 year fuel in the same location.

Dr. **Weinberg**. That is correct.

Senator **Evans**. Okay. Now, let's turn to the political side of it because I think that is important, and that was the original concept. And the problem is that the Nuclear Waste Policy Act of 1982, which I think was a remarkable document and was done very well with what we knew in 1982, is seriously off track.

I do not know what would happen. We have not come to the point where we have any legislation on the floor and we have not made those floor arguments. But if I had to guess today, I would guess that the issue or the direction that seems to have the greatest support currently is simply to put the whole thing on hold for a two year period while an outside commission studies the whole process and tells Congress whatever new direction we might take.

I personally do not support that, and I think that we can make continued progress. We may want to review, even with the help of some outside group, what is going on, but I do not think we ought to abandon any progress in the meantime.

It seems to me one of the biggest difficulties we have got is the extraordinary opposition of the so-called second tier states. I talked to one of my colleagues from a New England state who said that when he went home, he had not seen anything like the public reaction since the Vietnamese war days and the protests that occurred during that period of time.

And so, I think that there is no question that 70,000 tons was a political distinction. And I am just trying to find out whether through this careful process we can get to a point of first having some locations be willing to take at least some interim storage to break the logjam we now have. Nobody wants anything at the current point in time.

Dr. **Weinberg**. I have in my hand here—it was handed to me just a few moments ago—a page from the Congressional Record, July 10, 1987, a joint resolution adopted by the legislature of the State of Nevada to the Committee on Energy and Natural Resources in which it states: "Whereas, if Nevada is chosen to be a location for the facility"—and this is the geologic facility in Yucca Mountain—"it would severely strain the financial, environmental and human resources of the state. Now, therefore, be it resolved"—and then it goes on to say all the things that the State of Nevada, as represented by this legislative action by both houses of the legislature in Nevada, would ask of the Federal Government by way of compensation.

Now, possibly Senator Hecht is certainly more aware of this than I, but I guess the point is that, as I said in my testimony, it is not clear to me that there may not be some states, as represented, say, by this excerpt from the Congressional Record, that indeed would welcome a repository if the compensation is massive enough and lasts for a sufficiently long time. That, of course, bears on the question of 70,000, 100,000, 200,000. If a state accepts a repository and becomes comfortable with it, is it not possible that that state would rather be unhappy if the repository were closed and the compensation ceased.

Senator EVANS. I will let Senator Hecht respond to that when it is his turn for questioning.

I have a suspicion that that resolution of the Nevada State legislature was in essence saying if you are going to rob me, please don't take my pants too. And maybe it is more positive than that.

I was struck yesterday by the letter signed by 25 members of the legislature of my own State of Washington which I thought was an extraordinary letter and extraordinarily positive, especially speaking to the question of an MRS and an MRS which could help us do two things at once. And that is break the logjam of all areas of the country being against everything, and secondly, allowing us to move ahead faster on some of the high-level defense wastes which are at Hanford.

Dr. WEINBERG. Well, you mentioned "rob." I would suggest, sir, that it is a case of the State of Nevada robbing the Federal Government rather than the other way around. They have a list of about 20 different things. And I would love to move to Nevada if Nevada is subsidized to that extent by taking the repository.

Senator EVANS. We have also got to keep in mind that it is not the Federal Government. It is the rate payers of the various utilities.

Dr. WEINBERG. Well, there's the defense waste, sir.

Senator EVANS. The defense wastes are——

Dr. WEINBERG. Sol Burstein is absolutely right. The defense has not carried its share.

Mr. BURSTEIN. Mr. Chairman, before we perhaps proceed, I think we should correct any apparent misconception about this heat load. I agree entirely with the table that Dr. Weinberg has presented to you. But we must remember that that is the heat load only at the time—or it pertains to the time at which the fuel is deposited in the repository.

Senator EVANS. I understand that.

Mr. BURSTEIN. That continually if we are going to talk about leaving it in a geologic formation for decades or hundreds or even thousands of years, that heat load is entirely different over the total life of the plant—the repository system—than merely that which is provided in the initial installation or deposit.

Senator EVANS. That is correct. The heat load decays over time. I understand that very well. But you have to design a facility for the heat load at the time you put it in. That is essentially what——

Mr. BURSTEIN. And I think any prudent designer would do that whether it is specified at 50 years old because we all recognize that things do happen. And perhaps we may have to take 20 year old fuel.

Senator EVANS. Well, you would not have to take 20 year old fuel if you had alternative storage facilities for that younger fuel.

Mr. BURSTEIN. Indeed. But that's the contingency that we speak to.

Senator EVANS. And that is what I want to get to.

First, let me continue with Dr. Weinberg. You talk about recycling, and I will put some of that off to Senator Hecht if he wishes to ask questions on it. But why in your view do the French find recycling so apparently economically desirable and we find it so expensive that it is not appropriate? They not only do it for themselves, but for a good many others as well.

Dr. **Weinberg**. Well, that is a good question. And many of us in the American part of the industry do not fully understand the French economics or indeed the Japanese economics. But I think it has to do with a sense that—and I am speculating here—a sense that nuclear energy and uranium is much more important to the French than it is to us. Something like 70 percent of their electricity is now being generated by nuclear energy, and they do not have any—well, they have a little bit of uranium. Some of the former French colonies, like Gabon and the Ivory Coast do have uranium.

So, the French are very much more sensitive to this question of conserving uranium than are we. And they, therefore, look at this issue—and I am speculating to some degree. They look at this issue of energy independence in a somewhat different way than we do in the United States. With us it is purely an economic issue. And as Sol Burstein said, it does not look like it is going to be economic for a long, long time. I said maybe 50 years. It may be longer than that. But the French—they look on it from the point of view that they have all of their electricity essentially is going to be nuclear. Seventy percent is now, and they must conserve uranium. And I think that is the main reason why the French have moved in that direction.

Perhaps Sol has a different view on it.

Senator **Evans**. Well, let me just add one further thing to toss in. Then I would like Mr. Burstein's views.

Apparently the Japanese and the Germans and the British, the Belgians, and I do not know how many other flags we saw there, but a good many others think that it is appropriate enough so that they are paying the French to do reprocessing for them as well. And they have full choice apparently to do what they wish.

Dr. **Weinberg**. But not one of those countries has any uranium. And so the security of energy supply looms much more importantly in their minds than it does in ours I would say.

Senator **Evans**. Mr. Burstein?

Mr. **Burstein**. I agree that it was primarily the matter of an assured future fuel supply as part of a total system which we in this country planned for prior to the mid-1970s, as you recall, sir. We talked about a light water reactor system, a reprocessing system, a breeder reactor that would utilize the recovered uranium and plutonium materials, and a much smaller but certainly necessary geologic repository for the transuranic wastes that remain.

We started down that trail. We, of course, decided, and this Congress helped decide, that we would not proceed with the breeder reactor program, and that we would not proceed with reprocessing for a whole host of the reasons that were exhaustively debated and finally determined within these chambers.

So, it is a different situation in this country. I think that as you know, the French have proceeded with breeder reactor programs slower than they anticipated. The Japanese are proceeding with demonstration breeder programs as are other nations outside of the U.S.

And I think that without a complete, total system approach, reprocessing by itself becomes a very awkward situation because then we have to deal with the temporary storage of plutonium with its non-proliferation, with its diversion risks and all the other items that went under debate in the 1970s. We still have no complete cycle in which each part contributes to a whole without each of these pieces in place.

But ultimately, even in France and Japan and wherever we have a reprocessing system, we still must end up with a geologic repository. And they are looking for one the same as we are trying to accomplish here.

Senator EVANS. I understand that, and I will get to that very shortly.

Does it really make sense, however, Dr. Weinberg, in your view to go ahead to use up the cheap uranium that exists worldwide whether it is in 50 years, 75 or 100 years, and at the same time put in the ground and cover up and make very difficult to retrieve an energy supply that is extraordinarily valuable?

Dr. WEINBERG. I agree. I have never been in favor of disposing of unreprocessed wastes although I concede and our calculations have shown that it is not economic in the American situation now, but 50 years from now it could be different.

Senator EVANS. I should say to Mr. Burstein as well, the French now do not have that problem you mentioned of simply storing the plutonium until such time as there is a breeder reactor. They are mixing it with the uranium and putting it back into the light water reactors. So, they are reusing it currently and with the current generation of reactors.

Dr. Weinberg, does that change the economics at all of reprocessing?

Dr. WEINBERG. No. With American economics, that process is still not economic until the price of uranium goes up, say, to $150 per kilogram.

Senator EVANS. Well, that is with the American. Would that change in your view the economics as far as the French techniques and their policies are concerned?

Dr. WEINBERG. Well, again, let me say that we in this country do not fully understand French economics. And we think that the reprocessing in France, and the recycling, putting the plutonium back, is largely driven by the desire for energy independence as much as economics and more so than economics.

Mr. BURSTEIN. We have, sir, as you recall, under consideration separate legislation dealing with the viability of the United States uranium mining industry.

Senator EVANS. I know it, yes.

Mr. BURSTEIN. I would hate to think what they might have to offer in the way of concern regarding anything that would further erode their market potential.

Senator EVANS. Well, I can understand that. But here again, if we get to the point where it is economic to do something else, we cannot afford to subsidize uranium mining. Well, I should not say that because we subsidize everything it seems to me. We subsidize our farmers. We subsidize a lot of things in this country. But it does not make any economic sense, does it, to subsidize a certain level of mining if there is a cheaper, better, more economic way to get the same result?

Mr. BURSTEIN. Yes, sir. And I merely emphasize that we went through all of that in excruciating and exhaustive detail when we finally determined not to proceed with reprocessing some 10 years ago.

Senator EVANS. I understand.

Mr. BURSTEIN. And I would agree again with Dr. Weinberg that when the time comes, that technology is available to us, and it can be deployed in an economic and I think entirely safe and secure manner.

Dr. WEINBERG. Let me say that that is why I really approved of the implication of—I think it was 1266 that we cannot really make a full decision on that point now. So, why don't we leave the stuff above ground for, you know, 50 years.

But on the other hand, I want to insist that we should not relax the pressure on the DOE to get going on geologic disposal and get rid of the defense wastes, and have the Defense Department of whoever pay for that.

Senator EVANS. I could not agree with you more since most of the defense waste is in Washington State's backyard.

You, Dr. Weinberg, talk about characterization of three sites in parallel being an expensive, tedious process and suggested going ahead on a sequential process rather than in parallel makes sense.

You also back the fundamental concept that at all three sites we should proceed on those elements that are most likely to disqualify a site—in other words, to do as we do in most of our other enterprises, try to find out first and least expensively those things that may jump up and disqualify something so that you can proceed to the next one and work in that direction.

Dr. WEINBERG. I guess I would agree with that. I have this sense that when you do three things in parallel like that, the operation becomes so awfully complex and complicated and takes so very long that the thing tends to lose focus. I do not know. Could the Department of Energy be asked, say, by the beginning of next year, of the three sites which you have already looked—and it is true the shafts have not all been built and so on, but you have some feeling for the sites. Can you among those three sites decide now which one you like the best, then which is the second best, and apportion your effort accordingly. But that is a detail that would have to be worked out.

Senator EVANS. Mr. Burstein, you have mentioned on several occasions that we went through all of this five years ago. But things have changed rather remarkably in the intervening five years, and maybe one of the most dramatic is that five years ago the rationale for site characterization at three sites was that it only cost $60 million each. And now they are talking about $1 billion each. It seems to me that is a fair change in circumstance and ought to be at least one of the factors that would lead us to some potential change in how we do things. Do you agree?

Mr. BURSTEIN. Absolutely. I think it is a most dramatic change when we seem to have to answer to every conceivable question that has been raised concerning the suitability of one of these locations and at the same time we are prevented from getting the information that permits the answer to be forthcoming.

I agree and support a sequential site suitability or characterization process for among other reasons that I think it is the quickest and the most economic way of approaching it.

Senator **Evans**. One question of Mr. Burstein. You say in your full written testimony on page 3, "However, Congress should not link use of the MRS to receipt of a first repository construction authorization." We had quite a conversation on this in testimony yesterday. You are saying on behalf of the organization you represent that the two ought to be decoupled and that even though we should proceed—as I understand it, you are suggesting we should proceed toward successful characterization and construction of a deep geologic storage. We should not have to wait until that construction permit is issued before we proceed ahead with the MRS facility.

Mr. **Burstein**. Absolutely, because I think that linking directly contributes to further delay of the time when the Department of Energy will accept its first spent fuel shipment from some utility. I think it is essential that we get on with that program of what was envisioned totally under the Nuclear Waste Policy Act or else we continue to end up with small MRSs in each state.

Senator **Evans**. Let me turn to Senator Hecht.

Senator **Hecht**. Thank you, Mr. Chairman. You have asked some very, very good questions.

Dr. Weinberg, we are talking about what is economically feasible. I would have to say today, being a businessman and a banker for 35 years, it is not economically feasible to go out and buy farmland, buy the equipment and grow wheat today. Yet, everyone—five million people in America need bread every day. So, you cannot look at it on that basis alone. You have got to look at what is good for the nation as a whole.

Does it make any sense to you to handle military waste one way and civilian waste another way?

Dr. **Weinberg**. No, not really. Well, I am not sure I quite understand.

Senator **Hecht**. Let's forget politics. Forget politics.

Dr. **Weinberg**. But I am not quite sure I understand the force or your question.

Senator **Hecht**. We reprocess military waste. We do not reprocess civilian waste.

Dr. **Weinberg**. Well, yes. One could give an argument favoring that because the military reactors are run only for the purpose of reprocessing and getting the plutonium or tritium or whatever out, whereas in the case of the civilian power, you are running it to make electricity in the most economical way. And that may or may not involve reprocessing. So, there is a difference there, of course.

Senator **Hecht**. All right. Now, we have a deep geologic repository. We are going to have different compartments. This is going to be civilian waste, and this is going to be military waste. Would you approve of that, or would you rather continue like you said——

Dr. **Weinberg**. By all means, by all means. What we should really do—and I have never understood this. We should build the repository since the military waste—there is no advantage—no conceivable advantage—to keeping those above ground. Fifty years from now nothing is going to be any different with them than it is now. So, use the first repository initially—and I do not know. That might be for 20, 30 years—for the military wastes, and then at such time as it becomes clear that you either want to reprocess or don't want to reprocess, at that time you can use the same repository for the civilian wastes whether they are spent fuel or HLW.

Senator HECHT. But how do you know how to build it not knowing what you are going to put in it? And certainly it has different qualifications.

Dr. WEINBERG. No. Well, my assessment of the situation is that you would have, say, different chambers. I mean, some chambers would be for HLW; other chambers in that repository would be for spent fuel. But I do not think that there is all that much difference between the two.

Senator HECHT. You mentioned the Nevada resolution. Is it your interpretation that the resolution welcomes a repository?

Dr. WEINBERG. Well, I will just read what it says, Mr. Hecht.

> Whereas, the Nuclear Waste Policy Act establishes a procedure for selection of a site for a facility to dispose of HLW; and whereas, the Secretary of Energy is considering an area near Yucca Mountain for selection as a site; and whereas, if Nevada is chosen to be the location for the facility, it would severely strain the financial, environmental and human resources of the state. Now, therefore, be it resolved by the Senate and Assembly of the State of Nevada jointly, that if Nevada is selected as the site, this legislature strongly urges the Federal Government to provide assistance to mitigate the adverse effects of such a facility in the following areas.

And then it lists about 14 different areas that cover every aspect of Nevada's well-being. And I think that is great because I think that ought to be the essence of the compensation package.

I think in the original NWPA, insofar as it spoke of compensation, it tied the compensation much too tightly to the specific aspects of the repository itself, like characterization, like monitoring, and so on. The resolution by the Nevada legislature is much broader than that and basically says, look, we do not like this. At least that is how I would interrupt it. But we are patriotic and we will go along, but only at a price, and that price should be a very high price. And I think that is the way the compensation should work.

Senator HECHT. And you feel that was a message that went out to the scientific community.

Dr. WEINBERG. I beg your pardon?

Senator HECHT. You feel that is a message that went out to the scientific community that Nevada, because of this resolution, does welcome it at a price.

Dr. WEINBERG. Well, I only quote what it says here.

Senator HECHT. No, I just wanted your interpretation. That's all.

Dr. WEINBERG. Well, I interpret it as simply meaning that the legislature says, well, if they are going to hang us with this, then the least we can do is make sure that Nevada becomes the richest State in the Union. I think that is great.

[Laughter.]

Dr. WEINBERG. I think that is great.

Senator HECHT. Okay. I just wanted your reaction.

Dr. WEINBERG. As I say, I would think of migrating from Tennessee to Nevada because our Tennessee people just do not want the

MRS. And I am not very proud of my colleagues in Tennessee for that.

Senator Hecht. But they want the jobs that they now have.

Dr. Weinberg. I'm sorry. I did not hear that.

Senator Hecht. They do want the jobs they now have with the nuclear energy.

Dr. Weinberg. Oh, yes. Yes, of course, yes.

Senator Evans. I might say, it is my understanding that that resolution of the Nevada legislature came as a result of a request by Representative Udall saying, in essence, if you are going to get picked, what is going to be necessary. So, I do not think that was entirely self-generated. I think that they were responding to a theoretical question of the Representatives.

Senator Hecht. Mr. Burstein, are you aware that the National Association of Regulatory Utility Commissioners supports further research on the possibility of subseabed disposal?

Mr. Burstein. I have heard of that approach, yes, sir. I have several misgivings about that in this present context. Again, I look upon—from what I know of the subseabed disposal concept, it requires at least a decade or two of further research to try to get some of the facts that are necessary to even plan for such a scheme.

Secondly, as I am sure we all are aware. It requires international cooperation and agreement in terms of trying to implement any such program.

Clearly, we were aware of all of these things several years ago when consideration went into the Nuclear Waste Policy Act debates and enactment. And to my knowledge, nothing has occurred in the subseabed developments that changes that picture in the last five years.

Senator Hecht. I think 10 or 12 countries are pursuing that. Mr. Rusche testified that we stopped. I spoke to Dr. Teller in the last few days many times on the phone. He says we absolutely ought to continue our research. Yesterday Professor Todorovich said the same thing. And the reason is if there is a possibility, why spend several billion dollars on site characterization of a nuclear waste repository if we might change direction. That is my question to you.

Mr. Burstein. Well, first of all, I do not think we know whether the possibility will ever turn into a probability. And it may take us 20 years to find out. And I just feel that we should not delay the bargain we made under the Nuclear Waste Policy Act.

I do not oppose, and certainly would, indeed, in some respects support, research and alternatives. But that should not be an excuse for delaying a program for which the American consumer is paying. We are already putting money into this fund on the basis that we were going to get something for it. And what we are saying, indeed, is we are not going to proceed. That seems to me to be breaking faith with what we said we were going to do. And I do not believe that that is something we should be entertaining.

Senator Hecht. Well, I brought out yesterday the Defense Department, who everyone knocks all the time, when they put a billion or two billion into a new weapon system, they see it is not right, they get rid of it. I mean, why put several billion dollars into a repository if 20 years from now we might say this is not the right way to go, we should have subseabed disposal?

Mr. Burstein. Again, sir, I am not sure that we would know that. I think that the geologic repositories are indeed an acceptable way to go. I think that we are merely trying to define the engineering and construction details of those facilities and not the fact that they are unacceptable.

It seems to me that all of these concerns that have been expressed about alternatives in the long run are seeking to avoid something that we have been through on several occasions in the past. And I must go back to remind us again and again that we have to get on with this job. Having decided after years, decades of debate and argument about what our posture should be, we made a decision. We can't be going back on that all the time. We will make a decision about seabed today, and 10 years from now someone will come along and protect the fish society and say you cannot do that. And then where are you? Right back where we are today, sir. I beg to express myself as strongly as I can in that respect.

Senator Hecht. Well, first of all, I think we are on the same wavelength. But we made a decision in the early 1970s. President Carter reversed that decision. Other countries around the world are taking the exact direction which we had in the 1970s.

Senator Evans and I and Senator Johnston and Senator McClure—six of us were over in France. They have the complete fuel cycle. They took our research, our technology, and ultimately we will go back to where we were in the 1970s. We will hire the French to come over here and do it for us, and that is what is going to be the answer. We made a mistake. We have to admit that.

Now, let's go back where it is a right direction. It is a safe direction. Doesn't that make sense to you?

Mr. Burstein. Yes, sir. And I would say to you again that all of these histories relate to a series of what I would call institutional situations and issues as opposed to technical ones and economic ones. But I see no change in the pattern of how we deal with these institutional questions. And I fear that in the future we will not deal with them any more effectively than we have in the past. And having gotten to a point, despite all of the histories, where we have made a decision, it seems amazing that we cannot stick with it for at least the time it takes to accomplish something.

Senator Hecht. I agree with you, but we made the wrong decision. We know—I would have a hard time bringing any nuclear scientist here, physicists, and say we are heading in the right direction. We made a political decision. We did not make a scientific decision. And that is where the rub is. There is too damn much politics on this whole thing. We should get on.

Time is short. I want to address myself to Mr. Hancock.

On your last page, your very prophetic words, "Many jobs held by our membership are at stake. Further, without clean and inexpensive electricity, our Nation's economy and it workers will be hard-pressed to compete with foreign nations." I just wish you were head of the entire labor movement and could get out and say that. Those are great words.

France understood this in the 1970s. They will soon be 75 percent nuclear, 25 percent hydroelectric. And when our plants start closing down by high utility costs, and when people cannot afford to work because they cannot pay for electricity bills at their house, France will be so competitive and they will take our jobs away from us.

And I thought your testimony was wonderful. And as a conservative Republican, very seldom do I stand up here and extol the virtues of a high labor official. But I just wish you were head of the entire labor movement and could get that out because what we are going to do is lose all of our competitiveness. We are going to lose our jobs worldwide. And we have got to address this situation. We have to have nuclear power. We are running out of oil.

Secretary Hodel sat right where you were several times this year and said he would not be surprised to see gas lines by 1990, and I just wish you could get your message out. I fully appreciate everything you said. I find no argument. I only extol your virtues.

Mr. HANCOCK. Thank you.

Senator EVANS. You should record that and take that back to the union.

Senator HECHT. You might get fired if you quote me.

[Laughter.]

Mr. BURSTEIN. Senator Hecht, if I may just add one final word. You know, we are designing these geologic repositories for something like 10,000 years or whatever. And I think that we must remember that no matter what kind of a system we have—and you know, heat loads and other things are going to average out over this period of time to where those are really not as vital issues as the concepts that you were bringing up. No matter what system we have, we are going to need some geologic repository at the end whether we reprocess or whether we do not. And we might as well face up to it.

All the countries that we are talking about in the world are looking at ultimate geologic repositories. They must have them. We cannot do any less, and so let's get on with it is our plea.

Senator HECHT. Let me just answer him one minute.

Senator EVANS. Yes, sure.

Senator HECHT. Again, I am going to quote Professor Todorovich and Dr. Teller. Why put fuel in the ground that we are going to need at a later time and can use? I mean, let's burn it and let's use it.

Mr. BURSTEIN. That is a societal issue that I could use for coal and fly ashes and all the other things. In our throw-away society, sir, right now, as you have heard from this panel questions of overriding and overwhelming economics, there will be a time when it will pay us to do that, and we certainly will.

Senator HECHT. Thank you.

Senator EVANS. Just before we leave, Mr. Burstein, you mentioned making a compact and let's get on with it. You certainly are an able advocate of doing what we said we were going to do five years ago. And let me just say that I do not think there is one chance in 1,000 that we will be able to do that.

I may not know too much about nuclear energy and all of its details, even though I was trained as an engineer, but I think I know from about 30 years of experience something about politics. And I can tell you, sir, that without some change or some modification in direction, I think we are going to face continued stalling, just nothing happening. And that is the worst of all worlds.

I think there is a chance to—you know, you say we made a compact with the people who are now paying something on their electric bills to get a final answer. That is true. Most of that is coming from people who live in the east and particularly the New England states. That is true. At the same time they are the most vociferous in opposing any kind of permanent solution if it affects any of them. And that is the current law, which says that we have got to have two deep repositories.

And unless we make some changes in the current law, I am just confident as I can be that there will be a yearly fight. And that yearly fight will focus primarily on budget and with the budget stringencies we now have, the easy side of that argument, and the one which I suspect will prevail, is the one which says let's put it off. Let's do something else.

And I cannot understand the idea that somehow because you made a decision five years ago, now going on six years, that we must stick with that decision. I do not care how many—30, 40, 50—years of study that went in before that. If circumstances have changed in the intervening time, or if we start down the road which we started down in 1982, and find that that road was an extraordinarily bumpy one, and that we are not making the progress that we thought we were, then it is time to see if there is a better way.

It is almost like saying that I, Henry Ford, have invented a Model T and we will always have a Model T and we will not look at anything else because that is the compact we made when we invented the Model T. We change in almost everything we do. It is the only way we can keep up with others. It is the only way we can make progress in the country. And it seems to me that there are opportunities to not change radically, but to modify what we do.

I think that at least in one circumstance you have pointed up one of the key elements, and that is detaching the concept of an MRS from that of a deep geologic storage. Give us a chance to at least get step one done before we finalize at least the whole ultimate answer of deep geologic storage.

Mr. **Burstein**. Well, we certainly want to work with you in any way we can to get it going. But I too, sir, would like to get even a Model T on the road. Let's get something started.

Senator **Evans**. Well, I suggested the Model T on road. It is far better than a Model T. But at least the first thing we can get, which is the first thing we ought to get, is an MRS rather than a deep geologic storage. We have constantly stalled on getting even an MRS, a packaging and a temporary storage place, built which other countries have done. They have all gone in that direction. They have all taken a different road than the United States. They have all been more successful than we have. Doesn't that teach us something that they have chosen—they have all chosen deep geologic storage. The Swedes, the French, the Germans. They have all proceeded first with an MRS and a place to collect and capably handle that fuel for an interim period of time. We have chosen to go in a different direction, and we have got a flat wheel.

Shouldn't we learn something, or don't you think there is something to be learned from the order of things that they have taken in other nations?

Mr. **Burstein**. We agree that there is an appropriate order. And indeed, that is what we understand the modified or the amended mission plan that the DOE has submitted does indeed create. We support that.

But we also support—and our comments have been vigorously focused on the idea of the ultimate geologic repository because sooner or later whether it is France or the United States or any other place, that is where we must end up. And it seems to me that we ought to have something going before we can even modify it. Otherwise, as I have said, this program continues to be paralyzed by seeking a better solution to a solution we haven't even got.

Senator **Evans**. Well, I think it has been paralyzed by some extraordinary insensitivities to the concerns of people, and we have not done the job we should have done in education, in really creating understanding. If we had laid a better groundwork instead of crashing ahead as the Department of Energy has attempted to do in the last five years, I think we would be a lot further ahead than we are now.

You cannot roll over people in this country. No matter how many laws you pass, you simply cannot roll over people. And unless you provide the education, unless they understand sufficiently that they have some considerable confidence in what is being done, they won't buy it. And if they won't buy it, neither will we as a Congress, any Congress.

This has been very helpful. I appreciate very much your testimony. And I hope that out of this will come the necessary modifications that will get us back on track even up to and including the appropriate progress toward a deep geologic repository which is contemplated and specifically set forward in the bill which I introduced on the MRSs.

Mr. **Burstein**. Let me express our industry's appreciation for your thoughtful insight and your extensive dedication to this issue. We certainly appreciate it, and let us offer again whatever resources we can provide to assist in a cooperative resolution of these most significant problems.

Senator **Evans**. I appreciate that. I hope before this Congress is over we have the appropriate change in direction. It may be modest, it may be fairly substantial but a change in direction that will get us out of the forest we are now in. We thank you very much.

Let's turn now to Dr. Charles Hollister, Dean of Graduate Studies, Oceanographic Institution at Woods Hole, Massachusetts. Welcome, Dr. Hollister, and please proceed.

STATEMENT OF DR. CHARLES D. HOLLISTER, SENIOR SCIENTIST AND DEAN OF WOODS HOLE OCEANOGRAPHIC INSTITUTION, ON BEHALF OF THE SEABED ASSOCIATION, ACCOMPANIED BY DR. JOHN E. KELLY, CHAIRMAN, THE SEABED ASSOCIATION

Dr. **Hollister**. Thank you very much.

My name is Charles D. Hollister. I am a senior scientist, dean of the Woods Hole Oceanographic Institution. You may recall recently we found the Titanic, which may give you some idea of the kind of undersea technology that we have developed at Woods Hole.

I have been involved in research on the subseabed disposal since 1974. In fact, I have been blamed or credited and then blamed again, as the case may be, for originating the subseabed disposal concept in the first place.

On my left is Dr. John Kelly who will help me wade through the bear traps on the non-technical side of the arguments, which I am sure we will hear.

I will keep my comments to a minimum to allow time for questions. I have written testimony I would like to submit for the record.

Senator EVANS. Please. All the written testimony will be included in the record.

Dr. HOLLISTER. Thank you very much, sir.

Mr. Chairman, members of the committee, I am here to tell you about an alternative method for the disposal of radioactive waste. Subseabed disposal which is, by the way, a deep geologic option. We want to make that absolutely clear that we are talking about a deep geologic option covered by a few miles of water which can get in the way and can help in some respects.

The concept is simple. Instead of digging holes in someone's backyard, we go to the most remote and least useful place on the planet, and we bury it in the seabed. In addition to not being in anybody's backyard, the seabed is technically the best geologic medium on earth for the disposal of radioactive waste I believe. And it is the largest single formation on planet earth.

The sedimentary formations that we have been studying for 12 years now, have been stable for millions of years and are likely to be stable for millions to come. This can be easily demonstrated by a simple piston core that we can take routinely in the ocean. We have identified stable areas where there are no fisheries, no commercially valuable mineral resources, no transoceanic cables, no human recreation, no shipping routes. That is, it is far from everything and mostly far from human beings that are to us the most unpredictable operators on the planet.

The sediment in these areas is a fine-grained clay about the size and consistency—about the consistency of Crest toothpaste, but looks like milk chocolate. I have a sample of it here for you to look at, what you have up there, sir. That sample came from a study site in the north Pacific.

We probably know more about this Pacific site than is known about any of the three candidate sites for first repository. The water is about three and a half miles deep and the sediment is about 100 meters thick.

This sediment is an excellent medium I believe for the disposal of radioactive waste because most radionuclides chemically bond to the grains of the sediment. Since the sediment is very fine-grained, there are lots of opportunities for the nuclides to glom on to or absorb onto the grains and not migrate through the sediments. So, if you bury radioactive waste in these sediments, most of it will remain there until it has decayed to virtually zero although some, very, very little of it, will get out. This is because some radionuclides do not bond to anything and have nearly infinite half-lives. These slippery, long-lived radionuclides will get out of any repository whether it is in granite, tuff, salt or basalt. The key factor is how much gets out and what effect it has on us and the critters.

Let me illustrate how little will get out of the sediment. If you bury 100,000 metric tons of spent fuel or the equivalent in high-level waste about 50 meters deep in the sediment, the peak effect on the maximally exposed individual would be equivalent to one ten-millionth of the background radiation that the average individual gets just by living. This peak dose would occur about 100,000 years after disposal.

Let me repeat that. One ten-millionth of background radiation, 100,000 to 200,000 years after disposal. And this is the peak dose to the maximally exposed individual, someone who lives on the beach and eats seaweed and shrimp constantly.

Now, how can we bury this stuff in the seabed? There are several ways, including deep ocean drilling, which I am very familiar with. But I prefer a simpler and safer method, the dynamic penetrator. This is a pencil-shaped object with a weighted nose cone and stabilizing fins that can be released from the ship and fall through the water column, and embed itself over 100 feet in the sediment by the force of its own momentum, sort of like a pencil. And we do this routinely in the ocean as well.

We have tested these penetrators and they work. We also could put pingers or acoustic devices on these penetrators that will tell us precisely where it is and what condition it is in. If there is any accident and we need to retrieve a penetrator, we can overcore the whole thing and bring it back.

We also can monitor a subseabed repository pretty easily. We spend a lot of time looking around the bottom of the oceans for things that people lose, things that our country has lost, things that other countries have lost. And we are pretty successful at finding little itty-bitty things way out in the middle of a big ocean. It is no longer Buck Rogers, and I think the Titanic exploration and the work we have done at Woods Hole on this and other deep ocean technologies will clearly illustrate that we can, in fact, work very precisely, and very well in very deep water anytime we want.

All in all, Senators, subseabed disposal appears to be a technically sound disposal method. We have every reason to believe that it would protect the public health and safety and would be considerably less expensive than land disposal. We estimate that the cost of developing an operational subseabed repository system that can handle the total U.S. need is $1.25 billion. Now, that is a lot of money, but it is a heck of a lot less than the mined repositories. And the time needed for a site characterization and to complete the science—that is, the time needed to tell us whether we should proceed or stop—is about 10 to 15 years. We are not taking 20 to 30 years as referred to earlier by Mr. Burstein. We can finish this work in 1995 and tell you whether we have a site and also whether the science tells us that everything is going as we had predicted.

But there are some warts on this baby. The politics are complicated as usual. We have been working on that aspect too. There is the International London Dumping Convention that probably would have to be modified unless we use a site within our 200 mile zone. We have a 200 mile zone out there that could be very exciting and used for this type of operation which would change and perhaps simplify the whole political issue.

And the U.S. Ocean Dumping Act would have to be amended in any case.

These are serious issues, but from our experience we do not believe that resolving the issues will be any more difficult subseabed than for the land disposal options.

So, where do we go from here? We know that the concept is sound, but we need to do site-specific work to validate our models. We need to characterize sites in the Atlantic and Pacific, including a site within our 200 mile zone. We need to test the penetrators at those sites. We also need to do the preliminary design work for a complete subseabed disposal system and develop the institutional options for managing subseabed disposal on an international, multilateral and unilateral basis.

We believe that the United States cannot afford to abandon the subseabed option. We need it as a backup to the first repository which is already in trouble. We need it as a candidate for a second repository. We need subseabed as a compliment to monitored retrievable storage to provide additional assurance that an MRS does not become a de facto repository, and we need subseabed for an international repository that all nations can use so that the efforts to site a land repository will not be complicated by the question of whether to accept foreign spent fuel for disposal in the U.S.

I digress to suggest that the politics of disposing somebody else's—some foreign country's spent fuel or nuclear waste into our backyard may be even more difficult than for our own waste.

In conclusion, we believe that this is precisely the wrong time to cut off our options for high-level waste disposal. Letting the subseabed option die now, in light of the problems with land disposal and in light of the new things we have learned in the ocean that tell us that we were right on target early on, would be like stopping payments on your health insurance just when you are running a high fever. The state of the U.S. space program attests to the risks of putting all of your eggs in one technological basket. I feel that we need more options, certainly more than one, rather than fewer options.

Now, these and other issues pertaining to finishing a scientific feasibility are addressed in the Senate Bill 1266 and 1428 by Mr. Evans and Hecht, and my written testimony goes into details on these bills specifically. So, I would like to use the remaining few minutes to answer some questions.

Thank you very much.

[The prepared statement of Dr. Hollister follows:]

TESTIMONY OF DR. CHARLES D. HOLLISTER
ON BEHALF OF THE SEABED ASSOCIATION
BEFORE THE UNITED STATES SENATE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
16 JULY 1987

Mr. Chairman and Members of the Committee, my name is Charles Hollister. I am Senior Scientist and Dean of the Woods Hole Oceanographic Institution. I am presenting testimony today on behalf of the Seabed Association, a nonprofit organization of scientists, universities, and private research firms that are committed to scientific, engineering, and policy research on seabed disposal of radioactive waste.

Subseabed Disposal Concept

The subseabed disposal concept involves the burial of high-level radioactive waste packages tens of meters beneath the deep ocean floor in areas where the geologic formations are stable and predictable. The waste would be isolated from the human environment by both man-made and natural barriers. The man-made barrier is the waste package, consisting of the waste form and canister. The primary natural barrier is the sediment, which chemically binds radionuclides while they decay to very low levels. Another natural barrier is the ocean water, which would dilute and disperse any radionuclides that escape from the sediment. The ocean would also constitute an effective barrier to accidental or intentional human intrusion. Potential subseabed disposal areas lie in international waters where the ocean is 4-6 kilometers (2-4 miles) deep, and the bottom sediment consists of very fine-grained clays or carbonate-rich sediment. These sediments form strong chemical bonds with radionuclides and, thus, would provide an effective long-term barrier to the release of radionuclides from the sediment into the ocean. Preliminary calculations indicate that subseabed disposal of high-level radioactive waste would pose risks to human health and the environment far below the Environmental Protection Agency standards for land repositories.

Background

U.S. research on subseabed disposal of high-level waste began in 1974 and ended abruptly in 1986. The Subseabed Disposal Project was funded by the Department of Energy and managed by Sandia National Laboratories in Albuquerque, New Mexico. More than twenty universities and research organizations were involved in the research at some point. By 1976, several other nations had begun research projects, and the Nuclear Energy Agency established the Seabed Working Group to coordinate the national projects. In 1985, ten nations and the Commission of European Communities had active research projects with collective annual funding of approximately $18 million; the U.S. portion was $7.5 million. In 1986, DOE terminated the U.S. project "purely on the basis of near term budget priorities."(1) In response to U.S. action, other nations decided to phase-out their projects, and the Seabed Working Group began to prepare an interim status report on research results to date.

Rationale

Congress recognized the need for research on alternative technologies in the Nuclear Waste Policy Act of 1982 (NWPA). Section 222 requires the Secretary of Energy to "continue and accelerate a program of research, development, and investigation of alternative means and technologies for the permanent disposal of high-level radioactive waste...except that funding shall be made from amounts appropriated to the Secretary for purposes of carrying out this section." The final caveat in this language, however vague, has been interpreted to mean that the Nuclear Waste Fund cannot be used for work on "various waste disposal options." Funds for subseabed disposal research, therefore, have been appropriated from general revenues, hence the "near term budget priorities" that led to termination of subseabed disposal research in 1986.

Congress also recognized the international dimensions of the waste problem and the dangerous link between commercial nuclear waste and nuclear weapons. Section 223 of the NWPA commits the U.S. "to cooperate with and provide technical assistance to non-nuclear weapon states in the field of spent fuel storage and disposal." This cooperation is intended to prevent the diversion of commercial waste to military use and retard the proliferation of nuclear weapons. In 1985, eight non-nuclear weapon states were conducting research on subseabed disposal and were cooperating with the U.S. under the auspices of the Nuclear Energy Agency. In response to U.S. termination, however, these nations decided to discontinue their research programs.

Subseabed disposal is the only credible alternative to land-based repositories for the disposal of high-level radioactive waste. The U.S. and other nations are trying to develop land repositories, but are encountering political opposition and technical problems. Failure or significant delays in the land repository programs will have profound consequences for the energy future of the U.S. and other nations. It is prudent to keep the subseabed option open until adequate land disposal capacity is operational or subseabed disposal is proved infeasible.

It is not too late to recommence research on subseabed disposal in 1987 and arrive at a decision on whether it is a feasible option by 1995, which is site-selection year in the land repository program. The one-year interruption will be costly in time and money but considerably less expensive than trying to restart the project at a later date. The U.S. research team has not dispersed entirely to other projects and could be reassembled at the universities, private firms, and national laboratories. The international Seabed Working Group, which is scheduled to dissolve after preparing a status report this year, can still be salvaged if the U.S. makes a firm commitment to completing the research phase of the project and actively solicits cooperation from other nations. International cooperation in this and other large-scale projects can yield significant cost-savings for the United States.

Termination of the subseabed disposal project for near term budgetary reasons was ironic. Even the Office of Management and Budget recognized that the subseabed project was an inexpensive hedge against possible failure of the very costly land repository program. International cooperation enabled the U.S. to derive full benefit of the research while paying less than half the total cost.

Budget considerations were not the only factor in the termination decision. The subseabed disposal project was perceived as competition with the land repository program. It is a fundamental business management principle that competing technologies cannot be adequately investigated within one research unit. The dominant technology garners all the resources to the exclusion of the alternatives. Subseabed research, therefore, should be removed from the Office of Civilian Radioactive Waste Management (OCRWM) and managed by the Office of Energy Research. To maintain its research orientation and avoid premature commitment to development, the project should be conducted by a university-based consortium involving national laboratories, private firms, and the public. This approach will enhance the credibility of the results and insulate the project from the politics of the land program.

Benefits

Recommencing U.S. research on subseabed disposal would have significant benefits. What are considered benefits from one perspective, however, may be draw-backs from another. The following list reflects various perspectives.

Back-up to the First Land Repository

The U.S. and other nations are trying to develop land repositories, but are encountering political opposition and technical problems. It is prudent to keep the subseabed option open until adequate land disposal capacity is operational or subseabed disposal is proved infeasible.

Candidate for the Second Repository

A subseabed site could be nominated for the second repository under the NWPA.

Complement to Long-Term Storage

Long-term storage of spent fuel, either at the reactors or at centralized facilities, is becoming a necessity. Active investigation of subseabed disposal increases assurance that long-term storage facilities do not become permanent repositories by default.

International Repository

Improper disposal of high-level radioactive waste by any nation can have global environmental impacts. The U.S., thus, has an interest in developing environmentally safe, international repositories that all nations can use.

Nonproliferation of Nuclear Weapons

Spent fuel, which can be reprocessed into weapons grade material, is accumulating in nations that currently do not have nuclear weapons. These nations, particularly the less developed ones, lack the geologic formations or economic resources necessary to develop permanent repositories for their spent fuel. Section 223 of the Nuclear Waste Policy Act is aimed at this problem, and a subseabed repository could provide the solution.

Science and Technology

The U.S. leads the world in oceanographic research. In numerous peer reviews, seabed research has received high marks for rigorous state-of-the-art work on an interdisciplinary problem. Significant contributions, with attendant benefits to naval interests, have been made in basic oceanographic sciences.

International Cooperation

International cooperation by independent national research and development programs is a productive and cost-effective method for addressing large-scale problems. By maintaining a strong subseabed research program and cooperating with other nations' programs, the U.S. can derive full benefit at a fraction of the cost of the total research effort.

Energy Security

As hydrocarbons become scarce early in the next century, the need for nuclear power may increase. A subseabed repository could ensure that the U.S. and its allies have adequate disposal capacity.

Trade in Nuclear Technology

The export market is the most active market for U.S. nuclear technology. Development of a subseabed repository would enable U.S. companies to export nuclear technology and ensure that the nuclear waste generated in other countries will be properly disposed. This would relieve concerns about nonproliferation and would avoid any future need to take back waste from nations to which the U.S. sells nuclear technology.

Compliance with the Nuclear Waste Policy Act

Numerous lawsuits have been filed against the Department of Energy for failing to comply with the provisions of the Nuclear Waste Policy Act. Failure to comply with Section 222, which mandates continued research on alternative technologies, will provide grounds for additional legal challenges.

Costs

The total estimated cost of developing a subseabed repository system is $1.25 billion, which is less than 10% of the projected cost of the land repository program. The estimated cost of completing the research phase is $250 million. At that point, characterization of seabed sites in the Atlantic and Pacific Oceans will be completed, and there will be an adequate scientific basis for deciding whether to proceed with the development of subseabed disposal.

Recommendations

The United States should recommence research on subseabed disposal of high-level radioactive waste and encourage other nuclear and non-nuclear nations to cooperate in the research effort. U.S. research should be conducted by a university-based consortium involving national laboratories, private firms, and the public. The university consortium approach will enhance the credibility of the research and maximize the educational benefits.

With adequate funding, the university consortium could achieve the following objectives by 1995:

(i) complete characterization of sites in the Atlantic and Pacific Oceans;
(ii) develop conceptual designs for a subseabed disposal system, including estimated costs and institutional requirements; and
(iii) identify and assess the potential impacts of subseabed disposal on human health and the marine enviroment.

In 1995, or upon achieving the objectives of its research plan, whichever is the earlier, the Subseabed Consortium would prepare and submit to Congress a final report on the results of its research activities. The final report will provide an adequate scientific basis for deciding whether to proceed with the development of subseabed disposal.

References

1. Statement on the Subseabed Study Project by the Department of Energy's Office of Civilian Radioactive Waste Management (1/5/86).

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ADDENDUM
"HIGH-LEVEL RADIOACTIVE WASTE STORAGE ACT OF 1987" (S-1266)

Summary Comments
We endorse the purpose of Section 222 of the S-1266, which is to strengthen the U.S. commitment to research on subseabed disposal and other alternative technologies and methods for the disposal of radioactive waste. However, we believe that section 222(c)(2), which makes funding for subseabed disposal contingent on the Secretary's determination that foreign governments are contributing an equitable share of funds, will effectively preclude continued research on subseabed disposal. We also believe that the $150 million in funding provided for subseabed disposal research is not sufficient to achieve the 1995 objectives set forth in the bill. We, therefore, recommend that section 222(c)(2) be deleted and that funding for subseabed disposal be increased to $250 million.

General Comments
Section 222 strengthens the commitment to research on alternative technologies, particularly subseabed disposal, that was mandated by Section 222 of the NWPA. The bill creates a university-based consortium to conduct research on subseabed disposal and sets forth concrete objectives for 1995. By establishing an Office of Alternative Disposal Methods, the bill elevates the visibility and priority of alternative approaches to the permanent disposal of radioactive waste.

We believe that subseabed disposal has many potential benefits, including:

- back-up to the first land repository,
- candidate for the second repository,
- complement to MRS,
- potential international option, and
- compliance with Sections 222 and 223 of the NWPA.

We endorse the university-based consortium approach to research on subseabed disposal. This approach will increase the credibility of research, provide a cost-effective method of investigating the option, and maximize the educational and ancillary benefits of the effort. If the subseabed option is proven to be environmentally safe and cost-effective in 1995, then it may be appropriate to transfer the program to a national laboratory or private firm to complete the engineering work leading to demonstration and implementation.

We endorse the creation of the Office of Alternative Disposal Methods. This action will insulate research on alternatives from the land-based program which has tended to view alternatives as competitive with rather than complementary to their efforts to solve the waste problem. In addition to subseabed disposal, we believe that island disposal warrants increased research. There also may be other potential methods which merit funding.

Section 222(c)(2). "No funds may be appropriated or expended (for subseabed disposal research) unless the Secretary has made a determination that foreign governments are contributing an equitable share of funds to international subseabed disposal research and development."

We surmise that the purpose of this provision is to encourage other nations to contribute to research on subseabed disposal. It is important to recall, however, that it was the United States that reneged on its commitment and terminated research on subseabed disposal, while other nations fulfilled their commitments and supported continued research. In a 1983 Report to OMB, the DOE set forth the objectives of subseabed research and a five-year budget commitment. The 1983 Report provided the basis for negotiating a five-year international research plan with budgetary commitments from other nations. In 1984 and 1985, the U.S. failed to fulfill its budgetary commitments while other nations stood by their commitments. When the U.S. terminated its program in 1986, other nations realized that they could not make up the difference. Rather than continue research on a piecemeal basis, other nations began to phase out their programs, and the international Seabed Working Group began to prepare an interim status report, which will be completed later this year.

Other nations, therefore, have lost confidence in the U.S. as a reliable partner in the international subseabed research effort. To rebuild confidence in the U.S. will require a firm U.S. commitment. If the U.S. makes a firm commitment, other nations will reaffirm their commitments and the cooperative international program can resume. If, however, U.S. funding is contingent on a determination by the Secretary, who terminated the U.S. program last year, other nations will not have confidence in the U.S. and will not be willing to commit their resources.

Section 222(c)(2), thus, will defeat its purpose and effectively preclude resumption of the cooperative international research program. We, therefore, recommend that it be deleted. It may be appropriate to strengthen the current language of Section 222(b), which directs the Secretary to "seek the maximum possible financial contribution from foreign governments," by requiring the Secretary to report annually to Congress on efforts to achieve this objective.

Funding

Section 222(c) provides $200 million for research on alternatives and allocates $150 million to research on subseabed disposal. This is insufficient to achieve the 1995 objectives for subseabed disposal research set forth in Section 222(b)(2). We estimate that it will cost $250 million to achieve the 1995 objectives. This estimate is based on a detailed research plan that was prepared in 1986.

Insufficient funding for subseabed research will have two consequences. It will delay completion of the feasibility assessment scheduled for 1995, and it will increase the uncertainty regarding the effects of subseabed disposal on human health and the environment. Both consequences will undermine confidence in the subseabed option. We, therefore, recommend that funding be increased to a total of $300 million for alternatives, with $250 million allocated to subseabed disposal.

Senator EVANS. Well, thank you very much for some fine testimony and a review of what I think has been an exciting and an interesting piece of research.

As we look ahead, whether we are talking about a land repository or a subseabed or any kind of final repository, it has been said by many that in at least our original concept of a deep geologic storage of spent fuel, we would eventually end up putting in place the largest single concentration of potential energy place on earth, that is has more potential energy than all of the oil under Saudi Arabia even though we consider it waste.

If that is true, or even if it is a moderate percentage of that, and if we were to put spent fuel in subseabed disposal, how difficult or impossible would it be to retrieve it if at some future time we decided that that was valuable energy-producing material?

Dr. HOLLISTER. That is a good question. I think my gut tells me that to put spent fuel in the deep ocean is probably not the first choice. I feel like Dr. Weinberg that that may not be a place for spent fuel. I am more inclined to think that the disposal of high-level radioactive waste itself would be the thing to do in the subseabed and even low-level waste, and in fact, even some heavy chemical waste. But as far as the heat and the thermal energy is concerned down there, that is not a problem.

As far as getting it back, if you know where it is, you can get it back. We know where each of those canisters will be and we could get them back I expect a lot easier extracted by an overcore system that just comes down over the top and would pull the whole works back out, mud and penetrator, because we will know where each penetrator is in X, Y, Z coordinates to within a few centimeters. So, it is just a matter—like our deep sea drilling project. We can reenter a hole the size of that water glass any time, any place—you know, whenever we want to. So, the scales are not difficult.

I suspect that if you baokfilled a repository—and being a geologist I know something about the difficulties of rock mechanics—I suspect that the costs are probably about the same.

Senator EVANS. Let's get back to that initial cost. Your estimate in your testimony that the cost of preparing—let's look in parallel, deep geologic storage and subseabed. Assume both are successfully characterized, and you are starting from that point, and moving ahead on the actual construction and preparation for the receipt and including the receipt of materials to put in these two repositories. You are suggesting that the cost, as far as you can tell from the research which has been conducted to date would be just a fraction of that of deep geologic storage?

Dr. HOLLISTER. That is basically what our sort of engineering and economic forecasts tell us. But I might turn to Dr. Kelly if he wanted to address that.

Senator EVANS. Would you please identify yourself for the record?

Dr. KELLY. I am John Kelly, and I am the Chairman of the Seabed Association. I have worked on the seabed program with Charlie here since 1979 on the institutional issues and the economic issues.

Senator EVANS. Thank you.

Dr. **Kelly**. The estimated costs for completing site characterization, as we have stated, is $250 million. That is to characterize sites in the Atlantic and the Pacific and a site within the 200 mile economic zone.

Senator **Evans**. When you say site characterization, in your view would that be site characterization—would that be using the term in the same way we are using it for site characterization for a on-land disposal?

Dr. **Kelly**. That is to reach an equivalent understanding of the sites in the subseabed equivalent to the understanding of the land sites, which the land repository program would achieve through its site characterization program.

The estimated cost of proceeding from site characterization to a final operational repository is about $1 billion. But there is enough uncertainty around that—there is about as much uncertainty around that number as there is about the cost of a land-based repository.

For example, a subseabed repository system would need to have a packaging facility. If there were an MRS, that would be an appropriate place to locate that packaging facility. And the co-location of a subseabed packaging facility with an MRS would greatly reduce the transportation costs and facilitate the overall operation of a seabed repository system. If we don't have an MRS, and the seabed system would have to build its own packaging facility, that would increase the costs. So, we have made some assumptions in coming up with the $1 billion figure; namely, that there is an MRS somewhere, that there is a packaging facility that can be built, co-located with the MRS, and that we do have ready access to the ports.

And I might add that all of the sites which the Department of Energy considered for an MRS would provide good transportation to a number of different ports.

Senator **Evans**. What about the—would this also contemplate a reprocessing operation in that you are talking about actual subseabed disposal of reprocessed fuel or high-level radioactive waste rather than the spent fuel itself?

Dr. **Kelly**. In fact, the mission for the subseabed program, when it was operated by the Department of Energy, was to consider both the disposal of spent fuel and/or high-level waste. So, the cost estimates that we have done makes no distinction between the two. In fact, it makes very little difference in the end in regard to subseabed whether it is spent fuel or reprocessed waste.

Senator **Evans**. Isn't it true that if you were dealing with spent fuel, and the spent fuel rods, that you would be dealing with a substantially higher volume of material that you would have to deposit than if you were depositing a treated high-level waste?

Dr. **Kelly**. As Charlie can tell you, there are areas many times the size the State of New Mexico in the seabed that would be appropriate sites. So, volume is not really an important consideration.

Senator **Evans**. Except that you would have to have more canisters or larger canisters, but that is not a big part of the process?

Doctor **Kelly**. No. In fact, it has been an interesting exercise for us to realize how indifferent our concept is to the kind of waste you put in it—high-level waste or spent fuel. The volumes are relatively small when you think of volumes of the supertankers. We are talking like tenths of a supertanker. So, in the open ocean where we have tens of millions of square miles of this red clay junk that you have in that little vial up there to take a few acres or a few tens of acres of a few million acres is really very, very small. You know, it is a thumbprint in the whole north Pacific is twice the size of the whole State of New Mexico.

Senator EVANS. Physically tell me a little about the process of the penetration devices. Just how would you go about it and what is the end result when it hits bottom?

Dr. HOLLISTER. Well, I spent 30 years in marine geology. And I have found that keeping it simple is a very, very strong, driving design criteria for everything that we do in the ocean or perhaps anyplace else. And I spent a lot of time drilling with the deep sea drilling projects holes all over the world to get long cores to study the history of the earth. And that seems pretty stable, but I have twisted off bottom hole assemblies and other things. And I know that a big storm comes through halfway through, and you've got some problems. So, keeping something simple, keeping it quick to me is the essence.

And I envision, as I mentioned before, something with a length to diameter ratio that is pretty high, something like this pen. It could be anything from old sewer pipe to corrugated iron pipe to cement. It could be almost anything. All it needs to do is hold the material in a vertical sense like a flechette, a penetrometer, and have it go into the sediment vertically. It is almost impossible to have it land anywhere else except vertically if you have a proper design. We do this for deep sea coring all the time. We send over little things that go down to the bottom like little darts and then bring back the core back to the ship with a little float. And it is a very straightforward thing.

So, basically you simply have a ship that is loaded upside down—I mean, that is loaded with these things in a rack, and you open up the bottom and let them go down, monitoring them all the way down, talking to them just like we do with our space craft. We do it acoustically in the oceans very easily. And then after they go in, say, on 200 meter centers like a series of pencils in the clay, you go back and very easily with a deep toad system that we use for marine geology, we get the XYZ coordinates of each and every one of these. And you can make them big or small. That is really sort of irrelevant as long as it is long and skinny and heavy at one end and have fins at the other. But it is cheap.

Senator EVANS. Would these be guided on their way down, or would they not be guided?

Dr. HOLLISTER. It takes less than 10 minutes with the free-fall velocity for it to go straight down, and without any guidance whatsoever, we can hit a target, oh, about say 100 meters on a side without any problem at all. It is just like a ballistic——

Senator EVANS. With the weight and the design whatever ocean currents happen to be working at different depths would not in your view have the result of moving it any more than 100 meters——

Dr. HOLLISTER. Even less than that actually. In sort of 20 years of trying to hit targets with free-fall cores, free-fall entirely, just by shooting down there, just releasing them from the surface, the answer is that we are talking more like 20 meters error because basically the currents at the surface may flow this way, and then through the middle part may flow this way, and then at the bottom part may flow this way. So, there is sort of an integrated—the entire ocean does not move from left to right. The conservation of momentum just does not allow that to happen.

Senator EVANS. How deep are you talking as an optimum depth?

Dr. HOLLISTER. It's 30, 40, 50 meters. It is sort of the average length of some of our longer piston cores which are free-fall operations as well.

Senator EVANS. I meant the depth of the ocean.

Dr. HOLLISTER. Oh, 2 miles, 3 miles. It does not really matter to us.

Dr. KELLY. One of the things, Senator, that might be interesting to you is the preliminary ship design was done by a firm in Seattle, Glost and Associates. They did an interesting design of a ship that would enable—a packaging system that would enable waste to be put into the penetrator at a packaging facility that would be presumably co-located with the storage facility. That penetrator would then be put into shipping cask. And that cask would be transported by rail or barge to the port. The same cask would be picked up and put on the ship and would serve as the ship transport cask. And the penetrator would not be removed until the ship was at the disposal site.

And the interesting thing about this kind of an integrated transportation package is that you can use any port that will provide for a ship of medium draft and length. It does not require any special radiological protection or handling. And in fact, there is no radiological exposure from the packaging facility until the penetrator is removed at the potential disposal site.

Senator EVANS. You mentioned the extraordinarily small impact on individuals from whatever leakage would occur over that extended period of time. How assured can we be of that kind of protection or that level of protection? And what is the relative security of that compared with what we might find after extensive characterization in an on-land deep geologic storage?

Dr. HOLLISTER. Well that, of course, is the big question. There is no doubt. That is an enormous question. Let me answer it by saying that the physics predicts that our calculations are not off by more than a few percent, maybe 10 percent. So, we have a very robust set of calculations. There are some radionuclides in land and in the ocean, any geologic media. There are those nuclides that simply get through. There is no way to stop them.

And our option here is to be as far away from humans as possible when this stuff comes out and also to be in a very well mixed environment like the ocean so that if it does get out, it is mixed. And in fact, the iodine that comes out finds a happy home in the ocean where there is lots and lots of iodine and just becomes one more iodine molecule within the whole ocean basin itself.

And we continually sort of worst case our way through the calculations, and we find out that if you sit on the beach at the closest possible place and eat nothing but seaweed and shrimp every day all day for your entire life, you have not received more than you have received by basically just living.

We then did another calculation that said what if we lived on the sea floor and ate the mud just above the repository. And if you can imagine just eating that gunk you have in front of you and that is all you ate, you would die of a whole lot of other things long, long before you would actually be able to measure the radioactive uptake in your system.

Senator **Evans**. You'd die of mud poisoning.

[Laughter.]

Dr. **Hollister**. It would be the inverse of Kaopectate. No, it would be good Kaopectate actually. It would be excellent for that.

[Laughter.]

Dr. **Hollister**. So, I guess, quite seriously, that is the big answer. And the world is a probabilistic world. And what we do in the deep ocean is look for geologic boredom and predictability. If you take a core here and then you go 100 miles, take another core. And if it looks exactly the same, which it does in these big areas, then you take a deep yawn and say, okay, we will take a few more cores. And they all look exactly the same, which suggests that that part of the planet has not been changed over the recorded history in those cores, which is about 60 million to 70 million years, which is a complete record from when we take the core. Every page is there in the book in the core. We sit back and say the chances of something happening in the next million years when nothing whatsoever has happened in the last 70 million years is pretty small.

So, we are looking at geologic boredom, predictability, and that is what we find in abundance in the deep ocean and that is what is seriously lacking on land. On land you have glaciations. You have had changes of agriculture. People move back and forth. People dig here and dig there. It is very difficult to control what humans do. But if you are in 2 miles of saltwater and you are 1,000 miles out in the middle of the ocean, you have a better chance of predicting what goes on because human beings will not be roaming around there.

Senator **Evans**. Senator Hecht?

Senator **Hecht**. Thank you very much, Mr. Chairman.

I have been listening to you, so I have not read what you have given us. Basically, S. 1428, my bill on subseabed nuclear waste disposal—real briefly because we have got a hearing in about seven minutes, and I have got a couple of other questions I want to ask you—what is your analysis of this?

Dr. **Hollister**. Let me turn that to you, John.

Dr. **Kelly**. Speaking on behalf of the Seabed Association, we are very pleased with the provisions of the bill. And we hope that the Congress passes it.

We think it is very important to establish a university-based consortium as the operational way to conduct subseabed research.

The bill also, as we understand it, creates a special office for the investigation of subseabed in the Division of Energy Research which removes it from the Office of Civilian Radioactive Waste Management. We think that that is very important so that the subseabed program can be conducted as a rigorous, objective scientific research program insulated from the whip-saw politics of the land-based program.

The bill also establishes a very realistic set of objectives for the research in 1995 which we think with adequate funding can be achieved—that is, site characterization by 1995.

And we applaud the bill. We are very happy with it. We would like to see some budget numbers attached to it, of course. That is what makes the world turn. Generally, we are very happy with that provision.

In fact, it is really quite a mark for the subseabed program to have a bill called the Subseabed Nuclear Waste Disposal Act. We think that that is an appropriate way to recognize that subseabed is a viable disposal option.

Dr. KELLY. You did a good job. Stand up and take a bow.

[Laughter.]

Senator HECHT. Dr. Hollister, everything in this world today has to be very simple, and when they call us on television, I do not care what the problem in the world is, we have to have a 28 second answer because they need 32 seconds for a commercial. And that is it.

Dr. HOLLISTER. Our priorities are strange.

Senator HECHT. So, let's make this very, very simple. If we would proceed—in your opinion after all these years of research, if we would proceed with the MRS, as we have legislation, if we would recycle and get out all potential energy value, then are we on the right track to put this into the ocean? It would have all energy values out of it. Would it then be appropriate and feasible?

Dr. HOLLISTER. In 28 seconds, the answer is yes.

Senator HECHT. Thank you. I yield back my time.

Senator EVANS. My goodness.

Dr. HOLLISTER. Well, I have got another two seconds.

Senator EVANS. Well, you have had the 28 seconds. Now you can have the 32 for a commercial.

Dr. HOLLISTER. Can I have the 32 and his too?

Senator EVANS. You can have the 32 for the commercial.

Dr. HOLLISTER. A very quick commercial. You know, as far as the university consortium goes, we have the deep sea drilling project, and the deep sea drilling project is managed by such a consortium right here in Washington called the Joint Oceanographic Institution. So, we have the infrastructure. We have the management capabilities for this level operation. It is in place and ready to go. They have done a superb job with the deep sea drilling project. And it would be a piece of cake to add one more person, one more office, and move ahead with this if you so desire.

Senator HECHT. In your opinion then, that would be a very realistic way to handle this very complicated problem.

Dr. HOLLISTER. Very realistic.

It would be peer reviewed so that everything that we did would be open file. We would play the poker game with the chips straight up and tell everybody everything we have done. We have told and worked with the Cousteau Society, the Oceanic Society. We have told all the environmental concerns what we are up to. And we welcome them at all times into our camp. And we find it very nice and actually a wonderful experience to work with the environmentalists, with the public participation groups, hand-in-hand with the engineering and science. They do not like surprises, and we can actually use their advice. And it is a very important link-up and we are very proud of that.

Senator **HECHT**. Thank you.

Senator **EVANS**. Thank you very much for fascinating testimony. And with that this hearing is concluded.

[Whereupon, at 9:55 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Committee Questions

POST-HEARING QUESTIONS AND ANSWERS
RELATING TO THE JULY 16, 1987, HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

WITNESS: BEN C. RUSCHE, DIRECTOR
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

QUESTIONS FROM SENATOR JOHNSTON

Reprocessing

QUESTION 1: Testimony was given on July 16 that left the impression that reprocessing spent fuel would result in a significantly lower volume of waste to be disposed -- one witness indicated that as much as 95 to 97% of the spent fuel could be re-used and, thus, not require disposal.

QUESTION 1a: Is this an accurate statement?

QUESTION 1b: According to written testimony received from the Federation of American Scientists, the total volume of radioactive waste to be disposed would actually increase with reprocessing. Although the volume of solidified high-level waste would be less than that of spent fuel, they said that the total volume of radioactive material produced during reprocessing and plutonium fuel fabrication would be significantly greater.

How would reprocessing affect the volume of waste to be disposed? Would there be more or less radioactive waste requiring disposal?

QUESTION 1c: What would be the difference in the radioactive content of waste products resulting from reprocessing and the radioactivity from spent fuel that has not been reprocessed?

QUESTION 1d: Is there any value to recovering any of the shorter-lived isotopes in spent fuel?

ANSWER 1a: The statement that 95 - 97% of spent fuel is reusable may be theoretically defensible but no practical commercial experience to date supports these levels of recycle efficiency. This does not, however, imply that only 3-5% of the volume would then need to be disposed of. Radioactive hardware containing the fuel and the glass matrix into which the waste would be emplaced would result in much smaller volume reduction. For more detail, see the answer below.

QUESTION 1: (cont'd)

ANSWER 1b: Reprocessing would remove for recycle, storage or disposal, substantial percentages of long-lived radioactive elements. However, most of the highly radioactive fission products would remain and would still need to be disposed of. The Final Environmental Impact Statement - Management of Commercially Generated Radioactive Wastes (DOE EIS-0046 F. Volumes 1-3, September 1980) concluded that total repository requirements would be little affected by reprocessing.

For a given number spent fuel elements or a fixed quantity of energy produced, the total number of reprocessed high-level waste containers for disposal from a spent fuel reprocessing cycle is dependent on (a) allowable heat generation rate per canister for the repository host rock media, (b) spent fuel burnup, and (c) variations in the age, and thus the heat generation rate, of the waste at the time of disposal. In addition to high-level waste forms there will be a significant quantity of low-level waste forms and TRU waste forms resulting from the reprocessing cycle that will require disposal.

In summary, we agree with the conclusion that the total volume of radioactive waste for disposal -

QUESTION 1: (cont'd)

low-level, TRU, as well as high-level, would likely increase with reprocessing.

ANSWER 1c: Impacts of spent fuel reprocessing on waste disposal are addressed in Appendix C of DOE-RW-0006, "Spent Fuel and Radioactive Waste Inventories, Projections and Characteristics," December 1985. Assuming, for example, that 95,400 Metric Tons of heavy metal enters a reprocessing cycle, this would represent an accumulation of 38,446 X 10he projected radioactivity of the high-level waste glass logs resulting from reprocessing the amount of spent fuel is 31,178 X 10he latter figure does not include the effect of other reprocessing wastes such as cladding hulls and other structural parts of the spent fuel assemblies, as well as low-level and TRU wastes.

ANSWER 1d: Current technical experience with specific isotope recovery from spent fuel processing systems, shows that these systems have been designed primarily to recover fissionable uranium and plutonium for re-use in power reactors. Experience on the cost-benefits for the recovery of other isotopes is somewhat limited. Cesium and strontium were recovered at Hanford in the 70's for developmental use. However, ANSWER 1d (cont'd)

there does not appear to be much of a market, currently, for recovery of large quantities of such radioisotopes.

Prepared by: Bill Danker/586-9313
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR JOHNSTON

Reprocessing

QUESTION 2: How would reprocessing affect the spacing required for placement of waste in a repository?

-- At the July 16 hearing, one of the witnesses suggested that reprocessing could reduce the amount of space required by as much as 20 to 30%. Would this make for a significant difference in the size or cost of a repository? Wouldn't any cost savings be offset by the cost of packaging and vitrifying the high-level waste resulting from reprocessing?

ANSWER: Spacing of waste containers for emplacement in a geologic repository depends on a number of factors. It not only depends on the thermal output of individual waste packages, but also on characteristics of host rock in which the waste will be emplaced including rock stresses adjacent to the emplacement holes and mined openings, material strength, emplacement configuration (vertical or horizontal), etc. Current conceptual designs for the repository provide for emplacing spent fuel, defense high-level waste, and commercial high-level waste from the West Valley Demonstration Project. Trade-off studies on emplacement modes, waste package configurations, handling methods, openings design, etc., are expected to be performed during future design phases (such as advanced conceptual design). Detailed site characterization for collecting site-specific data at the three proposed sites for the repository is yet to be performed. In view of this, it is premature at this stage to

QUESTION 2: (cont'd)

predict what effect reprocessing may have on the spacing required for placement of waste in the repository, and accordingly, on the size of the repository. However, based on available information, our preliminary conclusion is that reprocessing would not significantly ease repository requirements.

The Department believes that impacts on repository costs should not alone influence decisions on whether or not to reprocess. Other economic, business, and policy factors are important. The repository will be able to dispose of either spent fuel or reprocessed wastes.

Prepared by: Bill Danker/586-9313
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 3: Testimony was given July 16 to the effect that there is no logical reason not to reprocess commercial spent fuel since we reprocess spent fuel resulting from defense operations. Testimony stated that we must rethink the rationale that led to the Carter Administration's ban on commercial reprocessing in 1977. But isn't it true that the main reason for not now reprocessing commercial spent fuel in the U.S. is economics? Isn't it true that disposal of spent fuel without reprocessing is a lower cost option that reprocessing prior to disposal?

ANSWER: The President, in 1981, lifted the indefinite ban that had been placed on commercial reprocessing activities in the United States. Reprocessing is now a utility and industry decision and they would be expected to make such a decision whether to invest in the development and operation of a reprocessing facility based on economics and efficient fuel utilization considerations. Whether costs are demonstrably lower to dispose of spent fuel before or after reprocessing is still a subject of some uncertainty depending upon the assumptions used. Cost factors relating to disposal of spent fuel are not, however, the sole criterion with regard to deciding whether spent fuel should be reprocessed or not prior to emplacement in a geological repository. At the present time, potential cost savings in terms of reduced quantities of wastes requiring disposal as a result of reprocessing does not play a major role in the overall balance of considerations. This is due in large part to the fact that reprocessing does not have a dominant effect in reducing the amount of nuclear waste requiring disposal nor in it reducing its heat load which is one of the principal considerations in the design of a repository.

QUESTIONS FROM SENATOR JOHNSTON

Long-term Storage

QUESTION 1: Dr. Alvin Weinberg included a chart in his testimony before this committee indicating the differences in heat load based on the age of spent fuel.

QUESTION 1a: Do you agree with the figures included in Dr. Weinberg's chart?

QUESTION 1b: Please tell us the difference in radioactivity between 10-year old fuel and 50-year old fuel. Are the differences substantial?

QUESTION 1c: What about the difference between 25-year old fuel and 50-year old fuel?

QUESTION 1d: Do the differences in heat and radioactivity make it prudent to *require* long-term storage prior to geologic disposal?

QUESTION 1e: What can you tell us about the cost differential, in terms of repository design, size, etc.?

ANSWER 1a: The figures included in Dr. Weinberg's chart appear to accurately represent the heat generation characteristics of spent fuel (in particular, 33,000 MWd/MTHM PWR spent fuel). The heat generation characteristics of high-level waste are dependent on several factors including type and burn-up of fuel reprocessed, the specifics of the reprocessing operation, and the time between the removal of the spent fuel from the reactor and commencement of the reprocessing operation. While his table did not specify all of these parameters, we conclude that Dr. Weinberg's numbers on high-level waste appear consistent with our information.

QUESTION 1: (cont'd)

ANSWER 1b: According to the data base which the Department has baselined for use in the development of repository and waste package designs (see J.W. Roddy, et al, Physical and Decay Characteristics of Commercial LWR Spent Fuel, ORNL/TM-9591/V1&R1, January 1986), spent fuel with an average burnup of 33,000 MWd/MTHM has a radioactivity of 3.9 x 10^5 Curies/MTHM for 10-year-old fuel and 1.3 X 10^5 Curies/MTHM for 50-year-old fuel. Therefore, fuel which has been aged for 50 years has approximately one-third of the residual radioactivity of fuel which has been aged for 10 years.

ANSWER 1c: Twenty-five-year-old fuel (with a burnup of 33,000 MWd/MTHM) has a radioactivity of 2.4 X 10^5 Curies/MTHM. Therefore, fuel aged for 50 years has approximately 55% of the residual radioactivity of fuel which has been aged for 25 years.

ANSWER 1d: Based on analyses done to date, it does not appear prudent to require long-term storage prior to geologic disposal. While present designs have been based on an average spent fuel age of 10 years, the age of spent fuel initially received at a repository will be up to about 35 years old and would gradually

QUESTION 1: (cont'd)

decrease in age as more fuel is accepted. This is based on the oldest-fuel-first approach for acceptance of spent fuel from the utilities and a repository start-up date of 2003 (Mission Plan Amendment). Future repository designs will be based on the expected range of spent fuel age received at the repository. It is currently expected that spent fuel received at the repository will average approximately 20 years old.

DOE currently believes there is little, if any, incentive to require the aging of spent fuel beyond 10 to 20 years when total system costs and impacts are considered, such as the additional storage costs, including surveillance and caretaker costs. The system will continue to be designed for flexibility in accepting fuels and will continually be evaluated for adjustments that can embrace performance, cost, and schedule.

ANSWER 1e: To date, no detailed study has been performed which compares the cost of disposing of 50-year-old fuel to that of disposing of younger fuel. The reductions in heat production and radiation from spent fuel up to about 20 years out of reactor could

QUESTION 1: (cont'd)

lead to benefits in terms of repository size, shielding requirements, and transportation. However, beyond about twenty years out of reactor, the reductions in heat production and radiation diminish such that design and cost benefits at the repository are minimal.

Prepared by: Bill Danker/586-9313
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 2: Dr. Weinberg stated during the July 17 hearing that the heat load from 2.3 times 70,000 MTU of 50 year old spent fuel would be approximately equal to the heat load from 70,000 MTU of 10 year old spent fuel (reference to the chart on page 2 of Weinberg testimony).

-- But does it then follow that you could store approximately 160,000 MTU of 50 year old spent fuel in the same space as 70,000 MTU of 10 year old spent fuel?

-- If not, why not?

ANSWER: Although the heat generation at the time of emplacement of 160,000 MTU of 50-year-old spent fuel is approximately equal to that of 70,000 MTU of 10-year-old spent fuel, it is not true that the same underground area would be required. The relationship between the age of spent fuel and the capacity of a repository is not a simple one and it varies among the three candidate repository sites. Emplacement of fuel that has been aged longer, and is therefore cooler, could lead to benefits in terms of repository size. At some point, however, repository thermal constraints give way to physical constraints. Rock mechanics considerations can impose minimum package spacing, regardless of reductions in heat load. Also, there are limitations on waste package size at some sites. For example, the weight of the waste package for the salt site in Texas is currently near the lifting capacity of the hoist; therefore, a reduction in the heat load of the fuel to be emplaced would not

QUESTION 2: (cont'd)

necessarily lead to an increase in the amount of fuel per package. An additional consideration is that increased emplacement density may negatively affect worker safety from an operational standpoint.

While detailed designs based on 50-year-old spent fuel versus 10-year-old fuel have not been developed for any of the candidate sites, analyses examining the affects of different spent fuel ages and burnups on repository design will be performed during the advances conceptual design phase of the program.

Prepared by: Steve Boerigter/586-5355
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM THE MINORITY

QUESTION 1: The Ogallala aquifer is quite large and extends into areas covering 8 States.

QUESTION 1a: Does this aquifer "flow" in a particular direction, similar to the way a river flows, making some States "upstream" of the Deaf Smith County site?

QUESTION 1b: The waste repository would be underneath this aquifer, and would not communicate with the aquifer. If, however, some accidental condition occurred that allowed physical communication between the repository and the aquifer, in which direction would water flow?

ANSWER 1a: Ground water does indeed "flow" through an aquifer; however, the analogy to the flow of water in an aquifer with the flow of water in a river is misleading. The passageways in an aquifer are, in most cases, microscopic pores or narrow fractures that are interconnected and allow the passage of water along a gradient. The rate of movement of water in an aquifer is much slower than that of a river, the flow rate in an aquifer being measured in meters or fractions of meters per year.

The ground water in the Ogallala aquifer flows from west to east; thus, the state of New Mexico may be thought of as being "upstream" of the Deaf Smith site. The concern of possible contamination of the aquifer and its effect on neighboring States would, therefore, be with States "downstream" of the site. The Ogallala aquifer does not extend beyond the State of Texas to the east and, therefore, there

QUESTION 1: (cont'd)

is no State whose ground water would be affected "downstream" of the site.

QUESTION 1b: In the event that communication between the Ogallala aquifer and the repository were to occur, the ground water would flow downward. However, the flow of water would soon cease unless there were also an outlet for the incoming water (e.g., a deeper aquifer beneath the repository). If, for example, the water entered the underlying Wolfcamp brine aquifer, the resultant water would flow to the northeast toward the State of Oklahoma. If there were no outlet, then the possibility exists that water could travel upward, by dispersion, to the Ogallala aquifer. However, previous experience with open boreholes in salt deposits would suggest that the passageway, no longer subject to enlargement by dissolution, would close because of the tendency for ductile deformation of rock salt.

Prepared by: Don Alexander/586-1238
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM THE MINORITY

QUESTION 2a: **Please provide an historical perspective on the policy/economic considerations that led to the present situation in the U. S. where spent fuel is not reprocessed.**

2b: **Why is reprocessing economically feasible in France, but not here?**

ANSWER 2a: In the 1960's, projections for the growth of nuclear power were such that it was expected that some 250 or more nuclear reactors would be built in the U.S. for commercial operation over the ensuing 30 years. To fuel these reactors, a reprocessing industry appeared to be extremely promising and a more economically desirable option than filling the fuel need entirely through uranium mining.

Three commercial reprocessing ventures were initiated in the U.S. The first reprocessing facility, located in West Valley, New York, operated for about 5 years, but operations were discontinued as new Government safety regulations were promulgated which would have required major capital investments for compliance.

The second facility, constructed in Morris, Illinois, was never operated with spent fuel feed since preoperational tests disclosed significant process and equipment deficiencies.

ANSWER 2: (cont'd)

Construction of a third facility was initiated at Barnwell, South Carolina, and although the plant was largely completed, it was never brought to operation primarily because of regulatory difficulties. The increasingly demanding regulatory environment of the early 1970's slowed progress in the completion of the Barnwell plant as additional facilities for plutonium conversion and waste solidification were required by the Nuclear Regulatory Commission.

Subsequently, concerns that the international spread of reprocessing technology would facilitate nuclear weapons proliferation gained popular support in the mid-1970's; and in 1976, President Ford responded to these concerns by concluding that "... we should pursue reprocessing and recycling in the future only if they are found to be consistent with our international objectives."

This was followed in 1977 by President Carter's indefinite deferral of U. S. nuclear fuel reprocessing and the Barnwell project and its licensing proceedings were terminated.

ANSWER 2: (cont'd)

Other countries proceeded with reprocessing regardless of the policy in the U.S., indicating that the 1976 unilateral U.S. prohibition of domestic reprocessing did little to alter the nuclear power strategies of other countries. Once the decision was made in the U.S., however, the reprocessing industry disbanded.

This Administration has demonstrated its strong support for the continued use of nuclear power to generate a portion of our electric energy needs, including reprocessing. On October 8, 1981, President Reagan issued a nuclear policy statement which called for several major actions including the lifting of the 1977 ban on commercial reprocessing with the caveat that the private sector take the lead in developing commercial reprocessing services. The Federal role, as stated in the policy statement, is to pursue stable long-term policies and eliminate regulatory impediments to commercial reprocessing while ensuring adequate safeguards.

Despite the lifting of the ban on reprocessing, the situation in the U.S. had changed. No new commercial nuclear plant orders had been placed

ANSWER 2: (cont'd)

since 1973; the growth of nuclear power was not growing at the rapid rate previously forecast; the uranium and uranium enrichment services industries were becoming depressed; the price of uranium was dropping; nuclear plant licensing was taking longer and, therefore, the cost of constructing and the time to come on-line was becoming prohibitively expensive; and nuclear plant orders were being cancelled. Further, U.S. policy emphasized that the importance of key economic decisions being made in the marketplace.

Conditions have not changed. There have still not been any new orders for new commercial nuclear plants. The price of uranium is still low. There is no ban on commercial reprocessing and the policy of the U.S. is for the marketplace to determine when investment to reprocess is economically desirable. Such a market signal has not occurred.

ANSWER 2b: Attached is a paper presented in May 1987 by Jean Lefevre, Director of Nuclear Waste Management for the French Atomic Energy Commission (CEA) that

ANSWER 2: (cont'd)

addresses reprocessing policies in France. We direct your attention specifically to pages 2-5 of his paper.

THE BACK END OF THE NUCLEAR FUEL CYCLE IN FRANCE

J.LEFEVRE

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As everybody knows, France is committed to a major nuclear power program. To explain why, no one could possibly do better than quote the four reasons given by Lord Marshall last June, at the Geneva European Nuclear Conference :

One : France had no coal,

two : France had no oil,

three : France had no gas

four : France had no choice

These hard facts are certainly still with us; they have been behind our successive governments' staunch support of nuclear power through the years. As a result , in 1986, practically 70% of the country's electricity was nuclear generated. This could not have been achieved, however, without the required research and development teams, technical know-how, industrial capabilities, and, last but not least, the very highest level of safety . Moreover, it does not necessarily explain why France has also opted for the reprocessing of spent fuel and the recycle of the recovered fissile and fertile material. I shall try and make clear both our strategy for the end of the nuclear fuel cycle and the reasons for our choice.

I. WHY DO WE REPROCESS SPENT FUEL ?

To start with the reasons for reprocessing - they were many and varied. Some are linked to the history of the development of nuclear power in France, others to economy , but the main one is that reprocessing is a logical follow-up of the nuclear power option : France is relatively lucky in having some domestic uranium resources. These, if duly husbanded, are sufficient to cushion any short term disruptions in world uranium supplies, whether they are due to political or economic upheavals or both, such as have been experienced in the oil market over the last ten to fifteen years. These domestic reserves cannot guarantee total long term deliveries to our power stations in all circumstances at a reasonable cost. Security of energy supply, vital to the economic and political survival of any nation, therefore makes reprocessing a must for France. It so happens that reprocessing was also a logical technical follow-up of our nuclear program effort. Originally developed for Defense objectives, successful reprocessing at Marcoule of the first natural uranium spent fuel elements, together with the somewhat premature hopes for the economic success of the fast breeder, opened great vistas . Building a new plant at La Hague, for the reprocessing of EDF and foreign civil power plant fuel, came as a matter of course, and , logically again, came the switch to light water fuel reprocessing. The world energy crisis and the ensuing committment to nuclear power, not only in France, but in many other countries, led to a surge in reprocessing orders and the decision, in 1977, to enlarge light water spent fuel reprocessing capacities at La Hague from 400 t/annum to 1600 t/annum by the early nineties. Licence to build was given by one Government in early 1981 and confirmed by the next in 1982, following a major energy policy debate in Parliament, in october 1981, and the setting up of an ad hoc working group. Headed by an independant and universally respected scientist, Professor Castaing, this group was given the task of scrutinizing the La Hague plant and projects and report with recommendations to the government to go through with the building plans or not. Among the members were some of the most qualified and vocal opponents of reprocessing. It says much for their fairness, that the Group unanimously agreed that reprocessing technology both of natural and enriched spent fuel had been successfully mastered by the Commissariat à l'Energie Atomique "in availability and safety conditions ... which have not been questioned (by the Group)". Many detailed recommendations were made by the Group on this or that aspect of the project, and especially on some of the waste management options, but reprocessing per se passed the test and the project is nearing completion. Thanks to the recommendations, clear government instructions for long term waste management were given, and the necessary financial and structural impetus granted to the waste research and development program. But I will go back to that later. I should like first to add that the future of reprocessing is not necessarily linked to the technical and economic success of the fast breeder reactor. Recycling of plutonium in light water reactors has been carried out experimentally for years. EDF has openly announced their policy of proceeding to such recycling on an industrial basis. The first 8 tonnes of MOX will be loaded into the St Laurent power station in the autumn of this year. Refueling rate of the French power stations should increase to reach 90 to 100 metric tonnes in 1995, corresponding to ten 900 eMW reactors or so burning recycled plutonium. Low enriched uranium recovered by reprocessing can also be recycled in the enrichment plants. For the utilities, utilization of recycled uranium is a matter subject to optimization in terms of time schedule, stockpiling policy and reactor fuel management. The main consequence of course of the recycling of uranium and plutonium is the impact on uranium demand, as I stated before. It would amount, by 1995, to a maximum of 12 percent of uranium needs in the western world, which is not to be sneezed at. Incidentally, the EDF MOX decision confirms, if need be, the economic advantages of reprocessing.

A final major argument in favor of reprocessing is, of course, long term safety. With reprocessing and recycle, large quantities of plutonium are not left in the waste . The very small quantities of highly active and of long-lived radionuclides, including remaining traces, but traces only, of plutonium, are given the extremely elaborate and expensive treatment which must be accorded to the whole of the spent fuel element if it is not to be reprocessed. This brings me to the second and final part of my talk, which is a description of the long term waste management policy in France.

I will not limit my talk to reprocessing waste however, but cover the whole of the nuclear cycle including the power reactor itself, as is only logical.

II. NUCLEAR WASTE MANAGEMENT

As I explained before, despite inevitable adjustments to the general economic and energy picture, and whatever the political pressures, the French nuclear power program remains sizable : 44.9 eGW at the end of last year, 58 eGW by 1990 and a possible 70 eGW by the year 2000. Nuclear plants even now generate 70 % of our electricity, at a competitive cost.

The accompanying domestic fuel cycle industry covers all steps, from uranium mining and milling to the reprocessing of FBR fuel, and shortly to the fabrication of MOX fuel on an industrial scale.

Obviously, the problems posed by the ensuing radioactive waste have somewhat evolved since the early years of our Civil and Defense program, in the 40ies and 50ies. Mananagement had to adjust both to technological changes, and to the growing scale of the program, that of the industrial plants themselves and that of the overall volume of wastes. The organisation of waste management had to be reviewed, in order not only to meet these growing volumes with the corresponding industrial scale technology, but to take over the long term responsibility of nuclear wastes. Last but not least, the pressure of public opinion, in France as elsewhere, forced the parties concerned, who had tended to consider nuclear waste issues, like other nuclear safety issues, a matter for specialists to be settled between themselves and safety authorities, to come out into the open and publicise their policy - with the exercice in clarification that such publicising usually entails. Accordingly, waste management policy in France has been set out in the CEA "General Radioactive Waste Management Program", which followed the above quoted Parliamentary Debate on Energy of October 1981, was approved by Government and published on June 19, 1984.

Before briefly recalling the general lines of this policy, the structures and distribution of responsabilities should be described.

WHO DOES WHAT IN NUCLEAR WASTES ?

The broad outline of waste management policy, the national rules, regulations and control, as well as the authorization and licensing of nuclear installations, waste disposal site included, are the responsability of the government. The main ministry concerned is the Ministry responsable for Industry.

Short term management is carried out mainly by the waste producers themselves up to, and including, temporaty storage at the production site. Long term disposal is the responsibility of a specialized agency : ANDRA, set-up by the Government in 1979 within CEA.

ANDRA has a wide mission which covers :

. Selection, installation and management, of disposal sites,

. Setting specifications for the system of barriers set-up between the waste and the environment, namely, the waste packages themselves, and the site engineered barriers. The specifications ensure that the safety standards set by the ministry are correctly observed.

. Ensuring quality assurance and quality control both during treatment and conditioning of the waste, and at the disposal site. (Apart from the usual inspections and controls carried out by the specialised regulatory authorities).

. In order to carry out its mission, ANDRA must also make forecasts on the production of waste volumes, so as to program future disposal sites in time.

ANDRA is funded by the waste producers on a cost basis, according to the volume and nature of the wastes delivered. Prefunding of future disposal sites is also charged to the producers according to future delivery forecasts.

Waste producers include the national utility EDF, COGEMA, the fuel cycle CEA subsidiary, the CEA civil and military research centers, and the usual miscellaneous producers - universities, hospitals, industry etc.

R and D is mainly carried out and funded by CEA, with some contribution from the European Community, and, through ANDRA, from waste producers. These, mainly EDF, carry out some research in their own laboratories, as also do various Universities and Institutes, either under contract to CEA or through their own funds. The transfer of technology to industry is ensured through equipment and service suppliers, many of them subsidiaries of CEA or EDF. These also carry out some research themselves.

Needless to say, this presentation is a deceptive over-simplification. The licensing procedures for nuclear installations, including waste disposal sites, involves all major Departments concerned, especially the Health Department, who have a right of veto. It also involves the public through a public enquiry.Though the Authorities still have the last word, this entails supplying an independant enquiry commission with far more information than formerly and taking account of founded objections. Besides , the policy itself, the rules and specifications, and even the research program, are discussed in committees and commissions. These include, in some cases, trade-union and/or environmental group representatives, outside specialists etc.

WASTE MANAGEMENT POLICY

Nuclear wastes have been divided into three categories, according both to the technological problem posed by the level of their activity and to the health protection problem posed by their long term potential hazard.

Category A

Category A, to be disposed of in surface or near surface sites, includes low and medium level wastes containing mainly beta and gamma emitters whose half-life does not exceed 30 years, with an alpha emitter content no higher than 370 $Bq.g^{-1}$ (0.01 Ci/t) averaged over the site. Maximum individual package alpha emitter content must not normally exceed 3.7 $kBq.g^{-1}$ (0.1 Ci/t) ; this can be extended, on a case by case basis, to an individual maximum content of 18,5 $kBq.g^{-1}$ (0.5 Ci/t). These alpha emitter limits are computed for the end of the monitoring period, i.e. a maximum of 300 years after closure of the site.

Waste forms can be cement grouts, bitumen or polymer resins, mixed forms or any approved solid form. The engineered site barriers developed by ANDRA are the now well known "tumulus" or mound, and monolith concept.

The one available disposal site of the sort has been running for 16 years in the north west of France, close to the La Hague reprocessing plant. It will be filled to its 400000 cubic meter capacity in a few years time. Total Category A waste volume is expected to reach about 800 000 cubic meters by the year 2000.

Category B

Category B wastes are any low and medium level wastes with a higher alpha content than admitted on surface sites. (TRU wastes). They stem mainly from reprocessing activities, with some military and research wastes. A great effort has been made and is still in progress in order to reduce their quantity, through sorting, separation and recycle, combined or added to volume reduction by incineration, crushing, leaching, etc. Embedded in cement grouts, polymer resins, bitumen, or mixed matrices, all TRU wastes are put into temporary storage, awaiting the availability of a deep geological disposal site, which will not be for some years. The volume is expected to reach between 60000 and 80000 cubic meters by the year 2000.

Category C

Category C is made up of high level wastes. The policy is to vitrify them, as is being done since 1978 in the industrial AVM plant at Marcoule, where over 1400 steel containers have been produced, containing about 560 tons of glass, representing over 1000 m^3 of liquid high level wastes.

Two larger size plants are being built for the vitrification of the high level liquid wastes from the reprocessing of enriched fuel at La Hague. The first, R7, will be available for active tests in 1987. The glass containers will be stored for cooling for a probable minimum period of 30 years, which leaves some time for preparing a final disposal site, but not much, since real disposal conditions must be known beforehand to optimize the overall barrier system.

THE DISPOSAL SITE PROGRAM

As the existing low level waste disposal site will be filled to capacity within a few years' time, the Government has given ANDRA the go ahead for submitting two further sites for approval, so that one or both could be commissioned in 1990. The preliminary work carried out by the bureau of mines (BRGM) for ANDRA made it possible to narrow down the search to three counties. Finally one site has been identified as suitable and the licensing procedure is now in progress. This entailed an intensive information campaign by ANDRA among all sectors of the population, starting with local authorities and the press.

As far as deep geological disposal is concerned, the Government has requested CEA to submit a proposal for a site for an underground laboratory. Four sites, one for each of four geological formations, salt, granite, clay and shale, have been selected early this year for further exploration, before chosing one of them for installing the laboratory. It is hoped that the site will be good enough to be qualified as a repository ; should the site prove not to be suitable, another laboratory would be built in one of the other three sites. In the other event, the laboratory would be developed into a final repository.

Although some options may still be open, the general lines of waste management policy have been laid and the major part of the techniques are available here and now.

CONCLUSIONS

To summarize, reprocessing has proven to be technically succesful, with a level of safety which is entirely satisfying not only for the public, but also for the workers; with the acquired experience, confidence in reliability and performance make the economics ever more attractive; finally, backed with a major research and development effort, the long term waste management program is well under way : there seem no reasons to doubt our confirming our achievements and realising our hopes for cheap power with safety for the future as well as for the present.

LIGHT WATER FUEL REPROCESSING AT LA HAGUE BY JAN. 1 ST 1987

> 5000 T SHIPPED FROM 60 EUROPEAN AND JAPANESE REACTORS

> 1600 T REPROCESSED

> 1200 TU RECYCLED IN ENRICHMENT PLANTS

> 7 T P_U RECYCLED IN FUEL FABRICATION PLANTS

A V M

OPERATION RESULTS BY MARCH 1 ST 1987

VOLUME OF TREATED LIQUID HL WASTE_1074 M^3

NUMBER OF CASKS ______________ 1432

WEIGHT OF GLASS ______________ 490 T

VOLUME REDUCTION FACTOR __________ 5 – 6

HOURS WORKED ______________ > 37200

4606

FUEL REPROCESSING INSTALLATIONS

GRAPHITE GAS NAT. U.	LWR	FBR
UP_1 MARCOULE FROM 1958		
UP_2 LA HAGUE 1966 - 1986	UP_2 LA HAGUE FROM 1976 UP2 800 FROM 1992 UP_3 LA HAGUE FROM 1989	AT_1 LA HAGUE 1969-1979 UP_2 LA HAGUE (IN DILUTION) SAP MARCOULE 1979 - 1982 TOR (5t/y) 1987 MAR 600 DECISION PENDING

QUESTIONS FROM THE MINORITY

QUESTION 2c: Would the design of the repository have to be changed if, at some later date, we decided to reprocess fuel, and then dispose of vitrified waste rather than spent fuel?

ANSWER 2c: Regarding the repository surface facilities, the designs can accommodate both spent fuel and vitrified waste canisters. Thus, there would be no need to reconfigure the surface facilities. The capability to disassemble and consolidate spent fuel might be eliminated leading to some limited simplification in the operation of the processing hot cell areas.

The overall impact on the subsurface design is also expected to be rather limited. However, more detailed analysis on waste package characteristics and design, quantities of packages to be handled, etc., have to be performed before definitive assessment of impacts on design could be established.

Since defense high-level waste for the Savannah River DWPF and a small amount (640 metric tons) of reprocessed commercial high-level waste from the West Valley Demonstration Project will be emplaced in the first repository and the reprocessing of spent fuel may be undertaken at a later date, the repository designs currently have the capability to accommodate reprocessed waste and future designs will not preclude a later decision to dispose of such waste.

Prepared by: Bill Danker/586-9313
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM THE MINORITY

QUESTION 3: What effect would a moratorium have on your contractual commitments with utilities to accept spent fuel by 1998? How would a moratorium affect the projected costs of the disposal system? How might this affect NRC's waste confidence ruling?

ANSWER: The proposed schedule as described in the Mission Plan Amendment is a success-oriented schedule. Any delay in the program due to a moratorium would result in a delay in receipt of spent fuel from the utilities at least equal to the moratorium. Such a delay would result in the Department being unable to meet the 1998 commitment contained in the standard contract with the utilities. The utilities would continue to be responsible for storing the spent fuel.

Article IX of the standard contract allows for an equitable adjustment of charges and schedules to reflect additional costs incurred through avoidable delays (within the "reasonable control" of the Department or utility). Unavoidable delays (beyond the control and without fault or negligence of the Department or utility) result in no liability or require only a readjustment of schedules to accommodate the delay.

ANSWER 3: (con't.)

The effect of a moratorium on the projected costs of the disposal system would depend upon the length of the moratorium and the degree of standby capability that is maintained. If technical expertise is maintained and contracts are not terminated, some costs would continue throughout the moratorium at a reduced level. Therefore, program costs would increase by those delay costs, in addition to increased costs during a ramp-up period following the moratorium and by inflation.

If it is decided that no technical expertise should be maintained during the moratorium, then the contracts would be terminated. This would eliminate the standby costs but would introduce significant contract termination costs in addition to higher ramp-up costs and inflation. Such a course of action also would raise serious questions about the ability to recover the technical expertise at the end of the moratorium. When contracts are terminated, the technical experts are assigned to other work and may not be available or willing to return to the waste disposal project. Also, considerable time delays could be experienced in procuring new contracts. The net effects on program costs depend upon the length of the moratorium, but

ANSWER 3: (con't.)

the net effects on the technical aspects of the program could be quite serious. For example, a moratorium of 18 months is estimated to result in approximately a 3-year delay in the 2003 start-up date for the first repository and if an MRS were to be approved, a delay of 18 months to 2 years in the January 1998 start-up of the MRS.

DOE is conducting a cooperative program to demonstrate licensed at-reactor storage technologies designed to assist utilities in enhancing spent fuel storage capacity at nuclear reactor sites. In addition DOE is coordinating spent fuel research and development to provide data to utilities for obtaining licenses for these new technologies. Licenses have been granted for two dry storage installations; other demonstrations leading to licensed storage technologies are continuing.

The NRC's waste confidence ruling passed August 22, 1984, reported a finding that spent fuel can be safely stored in utility reactor pools through about the year 2007 to 2009. This ruling will be revisited by NRC every 5 years. It should be noted,

ANSWER 3: (con't.)

however, that unless actions such as in-pool consolidation, at-reactor dry cask storage, etc. are taken, individual reactors will exceed their pool storage capacity as early as within the next several years. The current proposed schedule, as presented in the Draft Mission Plan, calls for the MRS to be operational in 1998 and the first repository in 2003. With the MRS scheduled to begin operations in 1998, a moratorium of 18 months is unlikely to affect the confidence rulemaking. A moratorium of several years could seriously jeopardize the conclusions of the confidence rulemaking.

RW-12
R. Milner:jc
586-9173

QUESTIONS FROM THE MINORITY

QUESTION 4: Do you feel that you have adequate authority under the NWPA to provide grant money to affected neighboring States? What is your definition of "affected neighboring State?"

If you feel that additional statutory authority is needed to provide grant money to neighboring States, what type of authority and guidelines would you recommend?

ANSWER: The Department does not have statutory authority under the NWPA to provide grant funds to neighboring States, or States bordering States in which potentially acceptable sites have been identified pursuant to Section 116 of the NWPA.

The fiscal year 1987 appropriations for the Department of Energy, Office of Civilian Radioactive Waste Management, included a provision to provide direct funding assistance from the Department to the State of Oregon under the NWPA in the amount of $2.5 million over five years. The funding assistance is intended for the purpose of researching, with respect to civilian nuclear activities carried out at the Hanford Federal Reservation in Richland, Washington, the effects of such nuclear activities on the health of the people of Oregon and on the environment of Oregon. In accordance with this Congressional direction, and at the request of the State of Oregon, the Department is providing Oregon with grant funds in the amount of $500,000 per year for five years.

QUESTION 4: (cont'd)

Regarding the question about the Department's definition of "affected neighboring State," the NWPA does not address or define neighboring or border States and as stated above, the NWPA does not provide for funding assistance to such States. The Department is not seeking authority to provide funding assistance to such States pursuant to Section 116 of the NWPA.

Prepared by: Allen Benson/586-1116
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM THE MINORITY

QUESTION 5: Do you think that use of the Waste Fund to finance study commissions and new nation-wide site searches is an appropriate use of this Fund?

ANSWER: The Department continues to believe that the blueprint formulated by the Congress and set forth in the Act is the best course of action to follow in solving the Nation's nuclear waste problem. Toward this end, considerable technical progress has already been made. This previous work has been validated and verified by peer reviews. To discard previous findings in favor of additional studies, and their associated costs, would not be in the best interests of the nuclear utilities, their ratepayers who ultimately bear the costs of the program, or the Nation. Additionally, there are no easily identifiable benefits to be derived from such a course of action that would further or enhance the solution to the Nation's nuclear waste problem.

QUESTIONS FROM THE MINORITY

QUESTION 6: What was the Department's rationale for cancelling its subseabed disposal research? Did the U.S. Government abrogate its commitment to a 5-year international collaborative research agreement? What were the reactions from the foreign participants to the U.S. decision to terminate funding?

ANSWER: The DOE/OCRWM subseabed program had two roles: (1) fulfillment of the requirement of the NWPA for DOE to pursue alternatives to mined geologic repositories, and (2) serving as a contingency were the repository programs to experience insurmountable difficulties, as portrayed in the contingency plans in the OCRWM Mission Plan. It was not deemed necessary to continue funding the program because the repository program is progressing and the candidate sites appear promising. Also, budget priorities were focused on activities to support geologic disposal and, with proper closeout, the subseabed program can be reconstituted at a later time, if desirable. Further, as noted later, many other countries appear to be taking a similar position. Termination in no way implies any adverse judgment on the technical feasibility of the concept or the excellence of the research conducted to date.

The U.S. Government did not abrogate a commitment to a five-year international collaborative research agreement. Under the NEA Seabed Working Group (SWG), the Department agreed to a five-year plan for cooperative research, subject (as always) to the

QUESTION 6: (cont'd)

availability of funds. Further, the five-year plan began in 1982, so 1987 concluded that portion of U.S.-funded research. The organization of the SWG is such that each participant provided funding for specific activities of interest.

Definitive positions by other countries on this research will be declared at the October 1987 SWG Executive Committee Meeting. The U.S., along with most other SWG members, will probably terminate funding comprehensive research on subseabed disposal this year. However, France, Japan, and Italy may continue short-term active research on special topics, e.g., hole closure experiment. There appears to be some interest in periodic reevaluations of subseabed disposal based on data from other oceanographic research. However, the progress in land-based geologic disposal and the competition for research funds has motivated most other countries involved in this work to take the same position as the United States. For example, Spain, Canada, West Germany, and Sweden are all currently focused on deep geologic disposal for high-level radioactive waste because the technology developed is considered to have a sounder scientific basis.

QUESTIONS FROM SENATOR HATFIELD

QUESTION 1: In the FY 1987 Continuing Resolution, Congress specifically told DOE that exploratory shaft drilling is not authorized at Hanford. In spite of this, it is my understanding that DOE has initiated a study to evaluate the engineering aspects of sinking shafts "to the first basalt flow." This 600 foot hole in the desert would not be considered an exploratory shaft. Is DOE trying to tell us that a "shaft is not a shaft?"

There is strong evidence that the acquisition of much needed data will be compromised by the sinking of any shaft. Would you please comment on this?

How will DOE confirm the suitability or non-suitability of any site if data is being destroyed in a rush to meet deadlines?

ANSWER: As explained on page 10 of the Office of Civilian Radioactive Waste Management Mission Plan Amendment (DOE/RW-0128, June 1987), if the evaluation of the of concurrent shaft sinking and hydrologic testing suggests that the integrity of the much needed data would be preserved, then it may be possible to start construction of the exploratory shafts to the 600 foot level as early as FY 1989.

At this point in the evaluation process, DOE cannot say whether the acquisition of needed data would be compromised by sinking shafts to the top of basalt concurrent with hydrologic testing. DOE is still in the process of making that technical evaluation, a process that was recently expanded to include technical representatives from the States and Indian Tribes in addition to DOE's own technical people. Also as explained in the Mission Plan

QUESTION 1: (cont'd)

Amendment, DOE will not start exploratory-shaft construction unless we are confident data would not be compromised.

Prepared by: Tom Longo/586-1223
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR HATFIELD

QUESTION 2: There is documentation from a 1973 study performed by Atlantic Richfield Hanford Company of off-site Iodine-129 contamination of the unconfined aquifer at Hanford. In fact, the report in my possession indicates that there is evidence that traces of Iodine-129 have been found on the opposite side of the Columbia River from the present nuclear facilities (the 200 area operations). This has many implications on the suitability of the Hanford site as a repository. Are you aware of this documentation, and could you comment on its accuracy?

-- Scientists plan to monitor for Iodine-129 in the future as a test of site integrity. This isotope is the one most likely to expose the public. Current contamination will not disappear for thousands of years. How can Northwest citizens be assured that the repository is performing as designed when you cannot tell new contamination from old?

-- It is my understanding that DOE did not reference this document in its May 1986 Environmental Assessment of the Hanford site. If this is true, it raises serious doubts concerning the integrity of the Environmental Assessment. Should not this document have been mentioned in the Environmental Assessment, and if so, why wasn't it?

ANSWER: We are aware of a 1973 letter report entitled, "Migration of Contaminated Groundwater Offsite," which we assume is the report mentioned. The data cited in the report, as well as additional information acquired through 1978, have been recently assembled and reviewed by a Hanford contractor working group. A data report summarizing this information is scheduled for release in the very near future and will be sent to you at that time.

QUESTION 2: (cont'd)

The accuracy of some of the early measurements referred to in the 1973 Atlantic Richfield Hanford Company (ARCHO) report are questionable because (1) "control" sampling sites were not used for the early (1966) measurements and (2) sample processing and contamination control procedures had not yet been fully established for ultra low-level Iodine 129 (I-129) analyses. For example, the traces of I-129 (up to .001 pCi/liter, as observed in 1966) in the nearest water supply wells east of the Columbia River decreased to levels not significantly greater than the control sites used for measurements made in 1973, 1974, and 1978 (2 X 10i/liter), or about the detection limit. The existing data are thus inconclusive concerning the existence of traces of I-129 across the river. Additional sampling using ultra-clean techniques, appropriate controls and well-completion information are needed to confirm or reject the suspected occurrence of I-129 in the water-supply wells.

With regard to distinguishing sources of contamination, I-129 is not the only indicator that could be used to identify radioactive waste migration from a repository located beneath the Hanford

QUESTION 2 (cont'd)

site. For example, tracers can be added to the waste package that would uniquely identify the source. Additional design measures could be taken if necessary.

The 1973 ARCHO document was not referenced in the Hanford Environmental Assessment (EA). The omission of this reference does not affect the integrity of the EA. The 1973 report was actually a proposal by the contractor to the Atomic Energy Commission (AEC) for the conduct of additional work to investigate I-129 in Hanford groundwaters and, as such, not appropriate as a reference in a technical document. We have found no AEC response to the proposal for this particular work. The information contained in this proposal does not alter the basis for the EA nor would it have changed the conclusion expressed in the EA. These data are included in a report on I-129 in Hanford groundwaters. The report, "WHC-EP-0037, Data Compilation: Iodine-129 in Hanford Groundwater," dated August 1987, is attached.

The occurrence of I-129 in shallow groundwaters at Hanford was discussed in the EA (Vol. I, pp. 3-112 and 3-113) and further elaborated on in response to

QUESTION 2: (cont'd)

a question on this subject (Vol. III, p. C.4-50). All such documents that were available were referenced and the significance discussed.

Prepared by: Tom Longo/586-1223
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR HATFIELD

QUESTION 3:	It is my understanding that federal high-level waste siting standards require consideration of the natural resource potential at a site. Exploration of Hanford has shown natural gas (methane) in the groundwater. Does this indicate that DOE has found that potentially adverse conditions exist at the site with regard to natural resources? DOE may find firm evidence early in site characterization that natural resource exploration would create a loss of waste isolation. If such evidence is found, would DOE disqualify the site immediately? Or is it DOE's intent to continue site characterization until the bitter end in an attempt to disprove or minimize their own findings? If site characterization will continue, how can DOE justify spending billions of dollars on this effort?
ANSWER:	DOE siting guidelines contain a number of provisions requiring consideration of natural resource potential of sites. Two potentially adverse conditions were considered to be present with regard to natural resources. Potentially adverse condition (1) refers to indications that the site contains naturally occurring materials (i.e., ground-water resources and natural gas in this case) in such form that economic extraction is potentially feasible during the foreseeable future. Potentially adverse condition (5) deals with the potential for foreseeable human activities that could change some hydraulic properties of the ground-water system important to waste isolation, and was also considered to be present at the Hanford site. Principally, these activities include ground-water withdrawal, water application, and deep fluid injection. As explained in the siting guidelines,

QUESTION 3: (cont'd)

the purpose of determining whether such potentially adverse conditions exist at a site is to provide an early indication of conditions that must be examined carefully before judging the acceptability of that site. Such examinations must evaluate the effects of other, possibly compensatory, conditions present at a site. DOE's planned program of site characterization is focused on such examinations.

If, at some point, the available evidence indicates that ongoing or likely future activities to recover valuable natural mineral resources outside the controlled area would lead to a loss of waste isolation at the Hanford site so that the requirements of the NRC and EPA regulations could not be met, the site would be disqualified. There would be no incentive and therefore no effort to continue site characterization until the "bitter end," and no reason to continue spending large amounts of money on that site.

Prepared by:	Tom Longo/586-1223
Typed by:	Kendera Henderson/586-1116
Date:	August 12, 1987

QUESTIONS FROM SENATOR HATFIELD

QUESTION 4:	If the Department were asked today, using currently available information, to make a recommendation on which of the three sites is most likely suited for a repository, which site would you name? Using the currently available data, what factors or potential factors would disqualify Hanford from being selected as the repository? In your opinion, do you believe that sufficient data currently exists that would allow you to construct a hierarchy representing the most well-suited repository site through the least well-suited site? Is actual site characterization necessary before any such judgments can be made?
ANSWER:	DOE today is not in a position to recommend a preferred site for repository development from the three sites just recently recommended and approved for site characterization. DOE's evaluations to date suggest that any one of the three sites could eventually be developed as a repository. DOE could recommend a single preferred site given a reasonable period of time. Such a siting decision would require a careful and detailed analysis that has thus far not been attempted or even scoped out. Relative to the question concerning the adequacy of data necessary to construct a ranking of sites, DOE believes sufficient data exist to do such an analysis but such an analysis could only be done roughly and there would exist a number of uncertainties. Techniques exist to quantify these

QUESTION 4: (cont'd)

uncertainties to some extent. Sensitivity analyses that vary over reasonable ranges of inputs could substantially affect the relative ranking of sites and would be an important component of such an analysis. Their purpose would be to ascertain whether specific judgments or data are crucial to the conclusions drawn from the analysis. Such techniques can only be used as tools to gain insights into the relative advantages and disadvantages of sites, and to make explicit to the reviewer the value trade-offs (such as dollars versus fatalities) that are inevitably part of all siting decisions. They cannot be expected to make a siting decision.

With respect to what factors could disqualify the Hanford site from being selected as the repository, the DOE siting guidelines specify 17 disqualifying factors related to the following:

Postclosure Period	Preclosure Period
Geohydrology	Population Density and Distribution (3)*
Erosion	Offsite Installations and Operations
Tectonics	Environmental Quality (3)*
Dissolution	Socioeconomics

QUESTION 4: (cont'd)

Postclosure Period	Preclosure Period
Human Interference(2)*	Rock characteristics
	Hydrology
	Tectonics

Prior to site characterization and nongeologic data gathering, DOE can make highly confident conclusions relative to eight of these 17 disqualifying factors, in particular, those associated with erosion, dissolution, population density and distribution (3), and environmental quality (3). At this point, all other factors must be considered as potentially disqualifying, although there is more uncertainty associated with some of these factors than others, e.g., postclosure geohydrology and preclosure hydrology. Much of the information required to make more-complete assessments of these factors can only be acquired through a combination of surface-based testing and experiments in an exploratory shaft facility.

* Indicates number of disqualifying factors.

Prepared by: Tom Longo/586-1223
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR HATFIELD

QUESTION 5:	What would be DOE's reaction to S. 1007 if its scope were limited only to the State of Oregon?
ANSWER:	The Department's position is that all parties should be treated equitably in the repository siting process, and that the NWPA ensures such equitable treatment. The Department has made significant progress in meeting the requirements of the NWPA despite the difficulties experienced in working with the affected parties. Any measures which would alter the equity established by the NWPA would further exacerbate an already difficult situation. The Department believes that the NWPA affords all parties an opportunity to participate in an appropriate manner in the siting and licensing of a nuclear waste repository.

Prepared by: Allen Benson/586-1116
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR MARK O. HATFIELD

QUESTION 6: On-site, dry cask storage has been suggested as an alternative to the construction of a Monitored Retrievable Storage (MRS) facility. Is the Department prepared or able to comment on the advantages or disadvantages of the dry cask technology?

ANSWER: The Department considers the on-site storage of spent nuclear fuel in dry storage casks at reactors to be a viable option for increasing reactor storage capacity; however, the Department does not see dry cask storage at reactors as offering any particular advantage to the Federal portion of the waste management system nor should it be considered an alternative to an MRS.

The storage of spent fuel at an MRS facility would be a secondary, not a primary, function of the facility. The primary function of an MRS facility would be to receive spent fuel from reactors, consolidate the spent fuel, seal the spent fuel in contamination-free repository-specific canisters, and then ship it to the repository for disposal. Such an MRS facility would both decouple repository operations from the logistics of scheduling and coordinating spent fuel shipments from over 100 reactor sites and greatly simplify the above-ground repository spent fuel receiving and handling facility since it would primarily handle contamination-free canisters of uniform size from

ANSWER 6: (Con't.)

the MRS facility instead of intact spent fuel assemblies of varying sizes and designs.
Dry storage at reactor sites would provide none of these functions for the waste management system.

Further, dry storage of spent fuel at reactors would be much more costly than storage at an MRS facility. Recent estimates place the cost of dry storage of spent fuel at reactors in the range of $60 - 125 per kilogram of uranium, depending on the dry storage technology selected and the extensity of its application at any one site. The Department estimates that storage at an MRS facility would cost approximately $40 per kilogram of uranium.

The need for dry cask or other extraordinary storage measures at reactor sites is a direct consequence of not having alternatives for shipping spent fuel off site in a timely manner. When most of the reactors currently in operation were designed, it was envisioned that reprocessing services or Federal disposal services would be available when, or shortly after, the reactors came on line, and so only limited on-site storage would be necessary. As a result of the cancellation of reprocessing and revisions of Federal policies and timetables for the

ANSWER 6: (Cont'd.)

availability of Federal disposal or storage facilities over the last decade, many reactors now have no choice but to increase their on-site storage capacities. The Department believes the need for reactors to take such measures should be minimized, and the Federal government should begin accepting spent fuel for disposal by 1998 consistent with the disposal contracts implemented under the NWPA which established 1998 as a target date for the start of repository operations.

QUESTIONS FROM SENATOR EVANS

QUESTION 1: On page 1 of your testimony, you list some positive observations relating to the current waste disposal program. What are some of the negative observations you might make?

ANSWER: While I am not sure that I would use the phrase "negative observations" in describing either problems that the program has encountered or dissent from States and affected Indian Tribes with regard to the implementation of the program, there have certainly been elements that continue to be of concern. I believe that they fall basically into three areas: 1) significant differences of opinion between affected parties and the Department of Energy with respect to the implementation of the program. This has been evidenced by the filing of over 40 lawsuits on issues associated with the first and second repository program and the Monitored Retrievable Storage program; 2) delays in the program, to a large extent, caused by either underestimates of the time required to perform certain very complex tasks or by voluntary efforts on the part of the Department to attempt to more fully involve affected parties that we felt were essential to carry out the spirit of the Nuclear Waste Policy Act with regard to public participation; and 3) the time needed to have in place early in the development of the program, a

ANSWER 1 (cont'd)

reasonable and effective Quality Assurance program at the sites where characterization will take place.

QUESTIONS FROM SENATOR EVANS

QUESTION 2: On page 5, you state that the impact of reprocessing spent fuel rods on repository design would be "limited." Could you describe what exactly the impact would likely be? What kind of reduction in volume of waste could we expect if we chose to reprocess commercial spent fuel? What level of reduction have the French achieved at their reprocessing facility?

ANSWER: With reprocessing, the wastes received at the repository would be of the form of borosilicate glass logs in canisters containing the fission products and actinides resulting from reprocessing. This waste form would result in a greater quantity of packages prepackaged and only require the addition of the disposal container at the repository before emplacement. The impact on the repository would be principally those surface aspects relating to the elimination of spent fuel disassembly and fuel rod consolidation operations, if undertaken, in hot cell areas, and the modifications to handling and emplacement operations for varying quantities of packages with different configurations and heat capacities than those associated with spent fuel rod emplacement.

In regard to volume reduction from reprocessing, we expect that there would be reduction associated with the waste form, i.e., glass versus spent fuel. However, it is important to note that the volume reduction focuses on only the reprocessed waste

QUESTION 2: (cont'd)

form, solidified high-level waste, and does not address the impact of disposing of other high and low-level wastes generated during reprocessing. Some of the fuel constituents adhere to the cladding hulls, which together with other structural parts of the fuel assemblies and the glass matrix, are themselves radioactive and constitute high and low-level waste category. During reprocessing, radioactive gases containing krypton-85 and iodine-129, among others, are trapped and collected. Additional reprocessing waste forms which must be disposed of include low-level wastes and transuranic wastes. Accordingly, we conclude that reprocessing would not significantly ease repository requirements. As an example, assuming the glass waste package contains the fission product waste from a greater number of spent fuel assemblies than a spent fuel waste package, the glass waste package would have an initially greater short-term heat generation. Therefore, the packages would be placed further apart and the repository area would remain approximately equivalent to that resulting from emplacement of spent fuel.

Based on published data available on reprocessing operations at Cogema, France, we expect that the French results are consistent with the above conclusions.

Prepared by: Bill Danker/586-9313
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR EVANS

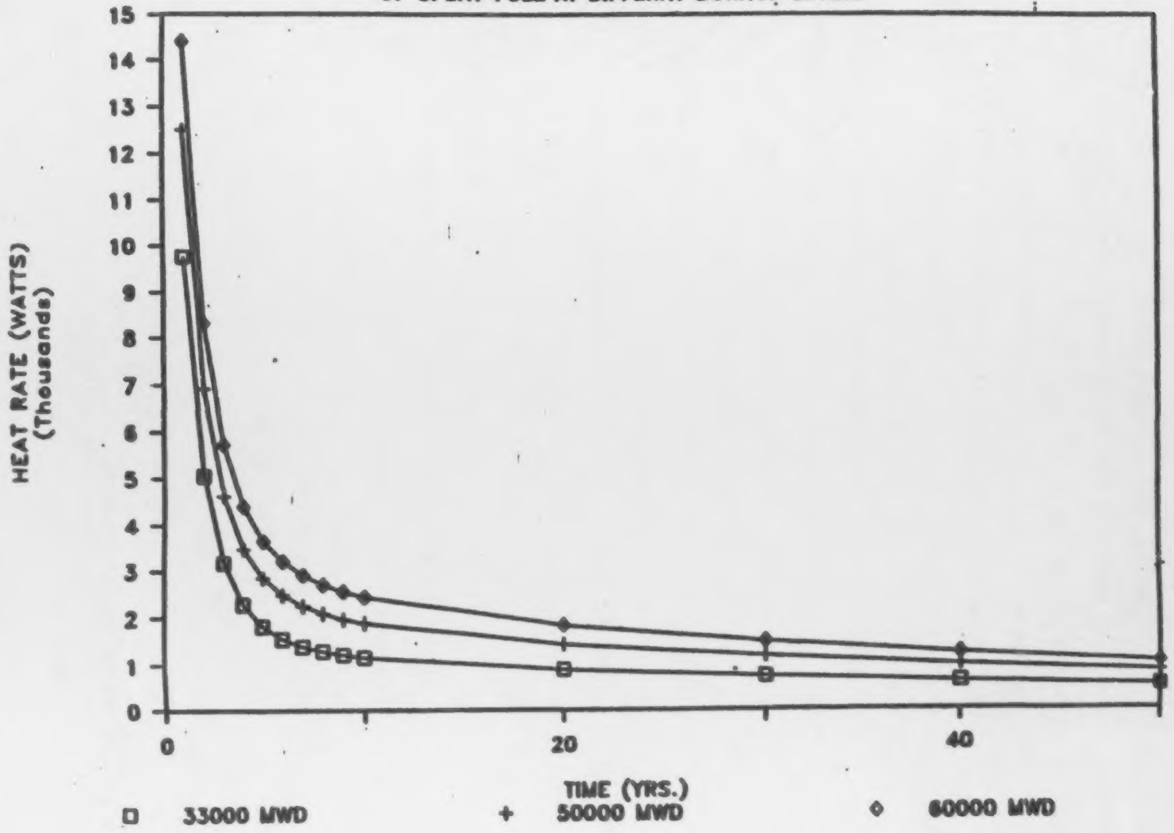
QUESTION 3: For what age fuel has DOE designed the repository?

ANSWER: Conceptual designs and design studies to date have been based on an average spent fuel age of ten years; however, the designs maintain the capability to accommodate fuel aged as little as five years, since 10 CFR 961 (the standard contract for disposal of spent nuclear fuel) designates spent fuel aged as little as five years out of the reactor as "standard spent fuel." In the next phase of design, DOE plans to base the design on the expected range of age (and burnup) received at the repository. The expected average age of fuel emplaced will be about 20 years old. As can be seen in the attached figure, the decay heat of spent fuel declines significantly for the first ten years out of reactor; however, the rate of decline lessens thereafter. The current designs include the effects of the most dramatic decline in thermal output. Repository designs for fuel aged beyond ten years would not be expected to be significantly different from the current designs based on ten year old fuel.

Prepared by: Naomi Moon/586-8980
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

DECAY HEAT PATTERN FOR 1 MTU

OF SPENT FUEL AT DIFFERNT BURNUP LEVELS



QUESTIONS FROM SENATOR EVANS

QUESTION 4:	What is the design basis for the thermal load of the repository? The Committee has heard testimony from the site manager at Yucca Mountain that it is approximately 57 kw/acre? Is this correct?
ANSWER:	Section 133(i) of 10 CFR 60 requires that the thermal loading of the underground facility be selected so that performance objectives are met while taking into account the predicted thermal and thermomechanical response of the host rock. Several thermal performance objectives exist, all of which drive the repository layout and design (e.g., borehole wall maximum temperature, emplacement drift wall maximum temperature, maximum surface temperature, etc.). The areal power density (APD) and the associated concept of equivalent energy density provide a single design parameter that can be used to ensure that all far-field performance goals are met. That is, as long as the waste is emplaced at less than the far-field APD, there will be reasonable assurance that the design meets the requirements of the applicable parts of 10 CFR 60. The design basis APD for the repository of Yucca Mountain is 57 kw/acre. Primary design considerations are borehole wall temperature limits and emplacement drift temperature limits.

QUESTION 4: (cont'd)

At the Deaf Smith County site, the APD is limited to a maximum of approximately 40 kw/acre to ensure that peak temperatures and creep closure are within acceptable limits to accommodate possible waste retrieval. The centerline distance between disposal containers will be maintained to be consistent within this maximum APD.

The overall thermal loading at the Hanford, Washington site lies in between that for Nevada and Deaf Smith County. The overall APD is approximately 50 kw/acre. As with Yucca Mountain, the design basis thermal constraint is not overall areal power density, but other factors such as emplacement drift temperature during the retrievability period.

Prepared by: Steve Boerigter/586-5355
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR EVANS

QUESTION 5:	According to a chart provided to me by a DOE engineer at Oak Ridge, fuel which has been aged 50 years has approximately one-third of the residual heat of 10-year old fuel. Is this consistent with your projections?
ANSWER:	According to the data base which the Department has baselined for use in the development of repository designs (see J. W. Roddy, et al, Physical and Decay Characteristics of Commercial LWR Spent Fuel, ORNL/TM-9591/V1&R1, January, 1986), spent fuel with an average burnup of 33,000 MWd/MTHM has a decay heat of 1140 W/MTHM for 10 year old fuel and 525 W/MTHM for 50 year old fuel. Therefore, fuel which has been aged for 50 years has approximately one-half of the residual heat of fuel which has been aged for 10 years. However, the radioactivity of fuel aged 50 years is indeed one-third of the radioactivity of fuel aged 10 years (1.3×10^5 curies/MTHM and 3.9×10^5 curies/MTHM, respectively).
	It should be noted that the current expectation is that the average age of spent fuel emplaced in the repository will be approximately 20 years old and will have a decay heat of approximately 870 W/MTHM.

Prepared by: Naomi Moon/586-8980
Typed by: Kendera Henderson/586-1116
Date: August 12, 1987

QUESTIONS FROM SENATOR EVANS

QUESTION 6: Would you provide the Committee with an analysis of the relationship between the age of the spent fuel rods and the ability to load waste into a repository limited by size, but not volume.

For example, if we reduce the heat of the spent fuel rods by one half by storing them outside of the reactor, is it then possible to place twice as much fuel in a repository without exceeding the design basis thermal load?

ANSWER: The relationship between the age of spent fuel and the capacity of a repository is not a simple one and it varies between the three candidate repository sites. Emplacement of fuel that has been aged longer, and is therefore cooler, could lead to benefits in terms of repository size (although most of the benefits of aging fuel should be realized with the DOE plans to emplace fuel that averages about 20 years old). Because the heat load would be less, it might be possible to place waste packages closer together in the repository, reducing the areal extent necessary to emplace a given amount of fuel. At some point, however, repository thermal constraints give way to physical constraints. Rock mechanics considerations can impose minimum package spacing, regardless of reductions in heat load.

Detailed designs based on spent fuel of various ages have not yet been developed for any of the candidate repository sites. Therefore, detailed projections

QUESTION 6: (cont'd)

of repository size as a function of fuel age are not presently available. Analyses examining the effects of different spent fuel ages and burnups will be performed during the Advanced Conceptual Design phase of the program.

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Date:	August 12, 1987

QUESTIONS FROM SENATOR EVANS

QUESTION 7: How much money could be saved in the overall waste program by:

a. Selecting sequential site characterization over simultaneous characterization of three sites?

b. If an MRS for commercial waste was located at a federal facility which is already likely to have an MRS-type facility to store high-level radioactive waste from defense production activities?

c. Cancelling the second repository altogether?

ANSWER: a. If sequential site characterization is pursued and if the first site characterized is acceptable, then savings on the order of $2-$2.4 billion (in 1986 dollars) would be realized.

b. The MRS, as proposed, serves many purposes in the waste management system. It prepares the spent fuel for disposal in a repository and also provides temporary storage for a limited quantity of spent fuel. This limited storage adds flexibility to the system by acting as a buffer between the utilities and the repository. In the MRS siting process, Federal facilities were considered, however, there are no existing Federal facilities that could meet the needs of the MRS without extensive facility modifications and the construction of new facilities. In fact, due to the different nature of all the defense and commercial waste forms, and the different

ANSWER 7: (con't.)

radioactivity and thermal loading, separate waste handling and storage facilities would be required for each waste form. The only quantifiable savings that could be realized by using an existing Federal facility instead of a non-Federal site would be in the area of site acquisition costs, security, and other infrastructure costs. At most the cost savings associated with these cost categories would not exceed 1-2 percent of the total projected costs of the MRS facility.

c. The Department has not conducted a detailed analysis of this option, but an approximation of cost impacts has been developed as follows. Cancelling the second repository altogether would eliminate development and evaluation costs for the second repository ($4.6 billion savings), eliminate payments to the second repository States and/or affected Tribes ($0.6 billion savings), increase transportation costs due to a longer operational period and longer overall haulage distances ($0.5 billion increase), reduce overall repository costs (cost impact at first repository - $2.0 billion

ANSWER 7: (con't.)

increase; cost impact at second repository - $7.0 billion savings; net impact - $5 billion savings), and, in an improved performance system, increase MRS costs due to longer operations for the first repository ($0.85 billion increase). The overall impact would be a savings of $9.7-$10.5 billion.

RW-12
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586-9173

QUESTIONS FROM SENATOR EVANS

QUESTION 8: What are DOE's best estimates of the costs of payment-in-lieu-of-taxes on an annual and lifecycle basis for both the MRS and the repository programs?

ANSWER: The Department's current estimate for payments-equal-to-taxes for the repository program over the near term (1987-89) is between $3 million and $9 million annually. Discussions are currently underway between the Department and State and local jurisdictions on several issues impacting payments-equal-to-taxes, including the identification of applicable taxes and valuation methodologies. Development of estimates for the out-years and, therefore, total life cycle cost estimates are pending the completion of these discussions.

The Department has not specifically estimated payments-equal-to-taxes for the MRS program as yet. However, in its MRS proposal submitted to Congress in March 1987, the Department estimated that annual payments to the State and local governments, including payments-equal-to-taxes, would be approximately $10-$15 million. This estimate was based on the $1 billion facility recommended in the MRS proposal at a site near Oak Ridge, Tennessee. The proposal also recommended that payments begin

ANSWER 8: (con't.)

with the year of authorization. Development of specific estimates for payments-equal-to-taxes and total life cycle estimates are pending action by Congress on the MRS proposal and, subsequently, discussions with State and local jurisdictions to identify applicable taxes and valuation methodologies.

RW-12
R. Milner:jc
586-9173

QUESTIONS FROM SENATOR EVANS

QUESTION 9: On page 9, you estimate that my bill would cost the overall waste program approximately $24 billion. What would be the cost of my bill with only 3 MRS facilities? Two MRS facilities?

ANSWER: The major effect of reducing the number of MRS facilities would be decreased payments to the States and local governments. The life cycle cost of a single MRS as an integral part of the waste management system is $3 billion, exclusive of payments to the State and local governments. This per MRS life cycle cost will increase as the number of MRS facilities in the system increases due to the loss in efficiency from operating more lower capacity facilities. Additionally, this bill would require that the entire waste inventory projected to exist by 2020 be stored at these facilities for a 50-year period. This results in significantly increased storage costs overall. Thus, when payments to State and local governments are considered, a system with two MRS facilities is estimated to increase the overall waste program costs by approximately $14 billion, and a system with three MRS facilities would increase overall waste program costs by approximately $19 billion.

RW-12
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586-9173

STATE OF WASHINGTON RESPONSES
to
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
JULY 16, 1987 HEARING FOLLOW-UP QUESTIONS

1. **What is your preferred scenario for the disposal of the defense wastes at the Hanford Reservation? In any case, do anticipate the construction of a MRS-type facility at Hanford as the Department moves ahead with vitrification of the liquid wastes?**

   We believe that the final disposal plan must be designed to comply with all applicable federal and state environmental regulations. It is important that the Department of Energy work closely and cooperatively with state officials in designing and implementing the final disposal plan. It will be necessary to construct a storage facility suitable for storage of the vitrified high-level defense wastes.

2. **Do you believe it is wise to support an open-ended shut-down of the nuclear waste disposal given the continuing accumulation of spent fuel rods at the nation's commercial reactors?**

   We support a mid-course correction to the site selection process, so that a repository can be developed in time avoid a crisis situation. We believe that the site selection process must be restructured before it can successfully move forward. The process must be scientifically-based if it is to have the necessary credibility to maximize confidence in its ultimate success.

3. **What indications do you have that the Hanford site will eventually be disqualified in the course of the continuing hydrologic testing at the site?**

   I have attached a copy of our site characterization focus paper which includes a discussion of several significant technical issues that could lead to disqualification of the Hanford site. In addition, we have provided information in response to a questions from Senator Johnston, Committee on Energy and Natural Resources (copy of response attached).

1. **The state of Washington has received $10.3 million in grant funding from DOE since 1983.**

-- What level of funding did the state receive in fiscal year 1986?
State activities are currently funded on a calendar year basis. The award to date, for calendar year 1987, is $5.9 million.

-- How much funding have you asked for or received thus far in fiscal year 1987?
We have submitted a grant request for calendar year 1988 in the amount of 13.3 million dollars.

-- Please tell us the major activities carried out by the state with this funding.
Our staff and/or contractors have conducted studies, prepared technical papers and made presentations in the areas of geology, hydrology, geomechanics, natural resources potential, and site contamination. A three dimensional Geologic Information System (GIS) has been developed to provide a comprehensive computer data base for all the above activities. The state has undertaken a socioeconomic impact study of a potential repository in eastern Washington. An ongoing public information program disseminates the results of the staff work to the Washington State Nuclear Waste Board, Washington State Nuclear Waste Advisory Council, the legislature, the governor, and citizens.

2. **Grant funding given to states for independent review has been a continual bone of contention between DOE and the states.**

We have worked out a mutually agreeable process with Richland DOE for our calendar year 1988 grant. The process has already commenced and we are optimistic that by January 1, 1988 we will have reached agreement and our grant will be approved.

In the past, we have had problems resulting from multiple Department of Energy reviews of our grant requests, which have caused significant delays in final approval of specific requests. Once again, we are optimistic that we have resolved this problem with Richland DOE, and we are hopeful that headquarters DOE will be equally responsive.

We do not believe that it would be necessary or advisable for Congress to act on each state and tribal request for funding.

3. **You state in your testimony that the nuclear waste program is in such a state of disarray that the only thing left to do is to place a temporary moratorium on all activity and establish a study commission.**

-- Aren't you concerned that the practical effect of this would be to repeal the Nuclear Waste Act and delay solutions to the problem of nuclear waste disposal for years?
No. We believe that our suggested course of action will get the program onto the track intended in the Nuclear Waste Policy Act of 1982, and is most likely to lead to the ultimate solution to the problem of nuclear waste disposal.

-- What makes you think that a study commission will help us to reach a new consensus on how or where to dispose of nuclear waste?
We have fully explained our position on this question in our recent testimony before Congress (copy of testimony attached).

-- Isn't a moratorium and study commission just a glorified way of postponing controversial decisions on nuclear waste?
No. See our testimony.

-- Isn't the coalition supporting a moratorium and study commission really a coalition of people that fear that nuclear waste will end up in their state?
No. See our testimony.

-- Isn't a moratorium and study commission just a cop out?
No. See our testimony.

-- Are you concerned at all that a moratorium will drive away competent technical people from the nuclear waste program?
No. We are more concerned that the arbitrary and political actions of the Secretary of Energy in implementing the site selection process, if allowed to stand, will drive away competent and conscientious technical people.

Followup questions for Yakima Indian Nation

Committee on Energy and Natural Resources

From Senator Johnston

1. The Yakima Indian Nation has received $5.7 million in grant funding from DOE since 1983.

--What level of funding did the tribe receive in fiscal year 1986?

Level of funding for FY86 - $2,034,659

--How much funding have you asked for or received thus far in fiscal year 1987?

Funding for FY87 - $2,836,984

--Please tell us the major activities carried out by the tribe with this funding?

Major activities:

-Consultation & Cooperation.

-Review & comment of all documents, information and reports concerning the selection of a geological repository under the NWPA.

-Attendance and participation at DOE-sponsored and other relevant meetings, workshops, and conferences.

-Dissemination of information to general public regarding NWPA activities and collection and catologing reference material.

-Interaction and exchange of information with DOE, other federal agencies, tribes and states, concerned citizens, interested groups and local governments.

-Monitoring and evaluation of DOE work associated with the proposed site.

-Administration of the grant funding and subcontractors.

2. Grant funding given to states and tribes for independent review has been a continual bone of contention between DOE and the states or tribes.

--When do you send requests to DOE?

> -Requests for grant funding are submitted to DOE on schedules they establish. Usually a minimum of 90 days for review is required. Amendment requests to fiscal year funding requires a maximum of 30 days review by DOE.

--Are these requests sent to DOE prior to the time when the Department formulates its own overall budget to allow the request to be easily factored in?

> -Requests for grant funding are submitted on DOE established schedules and we are not aware of the DOE plans regarding its own overall budget.

--Do you think it would be appropriate for Congress itself to act on each grant request, as part of the overall appropriations process?

> -We do not think it would be appropriate for Congress to get involved in individual grant requests. As far as grant funds to the Yakima Indian Nation to date are concerned, we feel that, on the whole, DOE is administering the program fairly, if slowly and ineffeciently.

-- Would you be able to tell us right now what level of grant funding you expect to be necessary for fiscal year 1988?

> -Grant funding for FY88 - $3,912,648

3. There is currently an on-site representative from the Nez Perce Indian Tribe at the Hanford Reservation.

--Has DOE offered the same opportunity to the Yakima Tribe?

> Yes. The Yakima Indian Nation has not yet filled the position of on-site representative. Grant funds have been requested and approved. Currently the staff technical advisor and technical contractors are acting in this capacity.

--Do you plan to have an on-site representative?

> -Yakima Tribe is currently interviewing for the position of on-site representative.

4. You state in your testimony that the nuclear waste program is

in such a state of disarray that the only thing left to do is to place a temporary moratorium on all activity and establish a study commission.

--Aren't you concerned that the practical effect of this would be to repeal the Nuclear Waste Policy Act and delay solutions to the problem of nuclear waste disposal for years?

A moratorium and review would not constitute a repeal of the NWPA. A possible outcome would be reaffirmation of the program established by the Act. In contrast, the proposal to pick just one site for characterization now is a clear-cut repeal of a key conservative aspect of the NWPA.

The importance of doing this job properly far outweighs the cost of a couple more years delay. Imprudent efforts to accelerate the program will greatly increase the possibility of failure, and possibly result in much longer delays.

--What makes you think that a study commission is not just a glorified way of postponing controversial decisions on nuclear waste?

It is not in the interest of the Yakima Indian Nation to postpone these decisions unnecessarily, and we do not seek to do so. Sixty percent (by volume) of the nation's defense high-level waste is at Hanford. We want to see solutions to the permanent disposal of those wastes as soon as possible, so we are not interested in delaying the repository program any longer than necessary.

Nonetheless, as DOE has destroyed the two-repository compromise that was the heart of the NWPA, and has politicized the site selection process, it is unavoidable that a temporary pause is needed to reassess the proper directions for the program.

--Isn't the coalition supporting a moratorium and study commission really a coalition of people that fear that nuclear waste will end up in their state?

Many moratorium supporters undoubtedly harbor such fears. So do many supporters of S. 1668. The difference is that the former are only asking that a fair and scientifically credible process be re-established, whereas the latter are simply seeking to designate the losing state (not theirs) sooner.

--Isn't a moratorium and study commission just a cop out?

No. It is a sincere, rational attempt to determine where the nuclear waste program went wrong, and to fix it in a manner which is based on scientific and technical merit, and is fair.

--Are you concerned at all that a moratorium will drive away competent people from the nuclear waste program?

We believe that the competent people will have to be involved in the review and re-assessment of the program. Both DOE and NRC are on the brink of letting enormous contracts to assist them in management of the program. Those contracts can simply be delayed. To the extent that people do leave the program, they will return or be readily replaced when funds once again are available to implement the program. It does not make sense to keep going in the wrong direction just to keep people employed.

RESPONSES TO FOLLOW-UP QUESTIONS FROM REPRESENTATIVE DICK NELSON'S TESTIMONY

In your opinion, is it enough to say that defense waste would be placed in a repository as the President declared in his declaration on co-mingling? Does that give you assurance that the defense waste at Hanford will eventually be disposed of?

For years the Department of Energy has been promising to safely dispose of the defense wastes on the Hanford Reservation. The Department's budget requests for defense waste cleanup are paltry, compared to the need. It has fallen to Northwest congressmen to fight for the necessary funds, since the Department has shied from doing so.

I am not particularly reassured by the President's co-mingling policy declaration. It is one thing to enunciate a policy; it is another thing to aggressively pursue it. To date not one nickel has been sought or appropriated to fund the co-mingling decision. Washington State legislators are not alone in their skepticism about the federal government's proposed policy on co-mingling. The nuclear industry has been clamoring in vain for the government to put some money into the Nuclear Waste Fund in pursuit of defense waste cleanup.

Recently the Nuclear Regulatory Commission issued an Advance Rule of Proposed Rulemaking on the definition of high-level nuclear waste. The target of this proposed rulemaking was the single shell tank wastes at Hanford. Current policies are clear that these tank wastes will be disposed in a deep geologic repository. The new proposed policy would put the ultimate disposal of these wastes in limbo. Washington State citizens would have no assurance that the wastes would be properly disposed of. For this reason, the state Nuclear Waste Board criticized NRC's proposed rule.

Rather than being reassured by the various declarations out of Washington, D.C., I am uneasy with the failure of our government to act responsibly on the problem of defense waste disposal.

On page 4 of your testimony, you mention that it might be more regionally equitable to establish 5 or 6 MRS facilities rather than the 4 authorized in S.1266. What is the best way to balance the scientific, economic, and regional issues that go into this decision?

There is nothing that has angered the Western states more than the irresponsibility shown by the Department of Energy in failing to comply with those provisions of the Nuclear Waste Policy Act which require regional sharing of responsibility for the disposal of nuclear waste. It is also apparent that Tennessee's opposition to an MRS is based primarily on the perception that an MRS would become a defacto repository and that they alone would be responsible for taking care of the nation's wastes.

Our national policy for the storage of nuclear wastes should be based on the premise that those who benefit from nuclear generation should also bear the consequences of disposing of its residues. This requires a more truly regional approach to nuclear waste storage and disposal.

Congress might look to the low level waste compacts for a model of a regional storage system. One of the benefits of these compacts is that they force the entire country to come to terms with the responsibilities of nuclear power. It is highly likely that technically sound MRS sites can readily be found in many states throughout the country. Finally, Congress could ease opposition to MRS siting by providing substantial financial incentives, such as those suggested in recent amendments to the Nuclear Waste Policy Act.

Washington State now serves as one of three national low level waste sites. This has been a sometimes contentious matter for us, but we have generated public support by an open approach to the issue. We are interested in possibly hosting a regional MRS facility that would be used for the cleanup of Hanford defense wastes. But our voluntary participation is dependent on being treated fairly by the federal government and fairly by other states. Like Tennessee, we have no desire to shoulder the entire nation's responsibilities.

On page 5 of your testimony, you mention that the state's Nuclear Waste Board endorses a moratorium on the current program. How long do you believe such a moratorium would be in force?

Eighteen months should suffice. It's short enough to keep us out of a permanent limbo on this issue, but long enough for a fresh look at the problems which have emerged in the last few years.

What concrete steps do you think are necessary to restore public confidence in the nuclear waste program?

First, the public needs assurance that nuclear waste disposal is grounded in science, not in politics. The Department of Energy has shown a penchant to mix politics and science inappropriately. An independent commission could help assure both the Congress and the public-at-large that inappropriate politics are being held at bay.

Second, a multitude of geologic media from numerous sites should be explored. Geologic diversity appeared as a compelling selection criterion late in the selection process, making that process a sham. Yucca Mountain and Hanford were included as candidate sites because they provided geologic diversity; yet they were the only basalt and tuff sites selected for review. Granite, which some countries find superior to all other media, was not even considered. The public (as well as USDOE's technical staff) could see through this in a moment. Additional sites, in various media, that include sites above ground water, should be more fully evaluated in the site selection process.

Third, the public needs assurance that alternatives to geologic disposal have been sufficiently explored. Very little attention was paid by the public to options for disposal until the repository program was well underway. We now have a much better understanding of the process. Moreover, we can learn from the experience in other countries which suggests that public acceptance can be gained if we proceed one step at a time. This is one of the real attractions to a regional MRS system, or of dry cask at-reactor storage.

Fourth, the public needs assurance that nuclear waste is not an east coast problem being resolved on the west coast. Wider public involvement, such as that necessitated by tradeoffs involved in siting low level waste compacts, should lead to greater public confidence. When citizens have the opportunity to act responsibly, they tend to be more supportive of decisions made by their leaders. When they are denied this opportunity, they lose confidence in their government.

Fifth, the states and tribes need a much stronger role vis-a-vis the Department of Energy or whatever federal agency administers the program. We have found it extremely difficult to get the Department to fund studies we think are necessary, for example, looking for a "fatal flaw" during the early stages of site characterization. We should be more concerned with the possibility that there is a good chance that none of the three sites chosen for characterization will qualify. Each site has its own unique set of problems. The complexity of the geologic media only becomes apparent after close scrutiny. There are several factors which have lead Washington state geologists to the conclusion that Hanford should be disqualified. If we continue to pursue the current program, without looking for the "fatal flaw" at a site, we may spend several billion more dollars with the result that no site can be recommended to the President.

Additionally it has been difficult to get the Department to release documents to us in a timely fashion, as seen recently with the iodine-129 data. An independent commission playing an oversight role could help assure a more balanced state-federal approach to this problem. For too long the states have been stuck in a reactive role. One suggestion for the moratorium commission to consider is requiring the states to come up with certain of the work products, which the federal government would then review.

If the affected parties were involved more directly in the work, and had the necessary resources to do a credible job, the public would be more confident that their needs were being protected.

Do you believe that under current conditions the public would ever accept a repository in their state? Is it ever going to be possible? What about an MRS?

A number of nations are now siting storage and disposal sites for their nuclear waste. None of them have had the problems with public confidence which we have experienced in this country, which is not to say it has been smooth sailing for them. So it appears not only possible but actually achievable to gain public acceptance.

Public confidence about nuclear waste disposal in this country is virtually non-existent in large measure because the program has been so poorly implemented by the Department of Energy. A program which is better managed, which shares the decision-making with affected parties, and which is based on a scientific approach, will gain greater public acceptance.

The Washington State Legislature and the state's Nuclear Waste Board have made it clear repeatedly that we would support a repository in our state if conditions were right, i.e. if the site were the best science could offer and if a fair approach were used in the selection and investigation of that site. Indeed, we are record as supporting a possible MRS facility at Hanford, under certain conditions.

Public acceptance is achievable if we don't treat the public with contempt.

You state in your testimony that the nuclear waste program is in such a state of disarray that the only thing left to do is to place a temporary moratorium on all activity and establish a study commission.

Aren't you concerned that the practical effect of this would be to repeal the NWPA and delay solutions to the problem of nuclear waste disposal for years?

I have no such fear. The moratorium that I support would take eighteen months. This is certainly a reasonable period of time to pause, reflect on where we have gone awry, and reposition the program. Nuclear waste will be around, essentially, forever. We should not be unseemly in our haste to get it out of sight and out of mind. Our obligation to this generation and future generations is greater than that.

What makes you think that a study commission will help us to reach a new consensus on how or where to dispose of nuclear waste?

I have an abiding faith in the reasonableness of my fellow citizens. In Washington State we have faced environmental and energy issues which seemed intractable. Yet we have found solutions to these problems by dealing with them openly and honestly. We have found mediated processes to be highly successful and have urged the Department of Energy and the Congress to use such an approach.

When people are treated with contempt, as they have been in this program, they respond with contempt for the process. When people are treated fairly and reasonably, they respond fairly and reasonably.

Isn't a moratorium and study commission just a glorified way of postponing controversial decisions on nuclear waste? Isn't a moratorium and study commission just a cop-out?

These are peculiar questions. They imply that anyone who is uncomfortable with the administration of the Nuclear Waste Policy Act has ulterior motives. They suggest that no matter how poorly the program has been operated, it should go forward. They suggest that we are doing the best we can and that anyone who disagrees is an obstructionist.

I think we can do better. This is a critical public issue. The future of the nuclear industry is at stake. The safety and well-being of the public is at stake. People's confidence in their government is at stake. To this point the country has not done a credible job in dealing with this issue. In fact, we haven't even come close to doing a credible job.

We need to take the time to do the job right.

Are you concerned at all that a moratorium will drive away competent technical people from the nuclear waste program?

Washington State legislators are concerned about this possibility, and we have discussed it at length. As I noted in my testimony , in order to protect information now being gathered, it's necessary to complete a number of scientific experiments underway. At Hanford, we are particularly interested in the results of the seismic and hydrology experiments. We will also need to continue characterizing the defense wastes on the Reservation, for ultimate disposal.

All of this will require competent technical people to complete.

State of Oregon Responses

to

July 16, 1987 Hearing Follow-up Questions

Questions from Senator Johnston

1. The State of Oregon received $500,000 in grant funding from DOE in fiscal year 1987 and will continue to receive this amount for 5 years. Please tell us the major activities carried out by the state with this funding?

   - Oregon's activities complement those carried out by Washington and the affected Tribes for the proposed Hanford repository. But our technical reviews are sometimes superficial and our participation is limited because of the small size of our grant. The areas with the greatest potential impact on Oregon are the highest priority. These are the potential contamination of the Columbia River and regional groundwater and transportation of waste through Oregon.

     A technical review team from nine Oregon state agencies reviews all major repository related documents. Some environmental monitoring of the Columbia River is now included under the US DOE Contract. Oregon experts are studying hydrology flow and geology for impacts on Oregon. Other experts have begun a transport impact study.

     The US DOE grant also allowed Oregon to expand its meager public information program. The 32 member Hanford public advisory committee was formed in 1985. They asked that public information be a high priority. Public presentations, printed information, public meetings and workshops have advanced this goal.

     Meetings with potential host states and US DOE are included in our activities. Oregon's concerns on groundwater, Columbia River and transportation issues are now discussed at these technical meetings. A copy of the current contract with US DOE is enclosed for your information.

2. Do you think it is fair to expect that all grant requests are honored, even if honoring those requests means that the field office must dip into its own operating budget?

   - Not necessarily. However, all reasonable grant requests should be honored for potential host states and tribes and those states near a repository that have a legitimate interest. It is clear that when risks to people and the environment of an affected state approach or exceed those for the potential host state, the adjacent state has a legitimate and compelling interest.

Independent evaluation of a repository by host and adjacent states and tribes is essential. US DOE's lack of credibility will allow no less. Ideally, grants should come from the Nuclear Waste Fund.

Decreasing the field office operating budget is not necessary to honor state grant requests, especially at Hanford where field office funds are needed to reduce the risks of some of the current operations. Funding for some of the field office activities, like clean-up of existing defense wastes, is woefully inadequate. We believe there are sufficient funds in the Nuclear Waste Fund and in USDOE's budget to honor host state and affected state funding requests and to fund essential US DOE field office activities.

Question:

Do you think it would be appropriate for Congress itself to act on each grant request, as part of the overall appropriations process?

Not necessarily. We believe it would be better for Congress to establish general criteria for eligibility through statute, as S1007 does and then have US DOE administer the grants and implement Congress' direction. Flexibility to amend the grant requests is needed. Congressional action for an amendment may preclude the grantees ability to quickly undertake necessary studies.

Question:

Would you be able to tell us right now what level of grant funding you expect to be necessary for fiscal year 1988?

We believe that Oregon should be declared an affected state and be allowed funding for grants of several million dollars per year.

If not, Oregon will work within the grant limit of $500,000 per year for 5 years contained in the FY 1987 US DOE appropriations bill approved by Congress.

The current $500,000/year grant will enable us to do a minimal evaluation of US DOE's activities at Hanford. It is not anywhere near the amount of money the State of Washington and affected Indian Tribes are receiving. The amount of money that the state receives indicates whether or not it will have the ability to work effectively on a detailed technical analysis of US DOE's efforts. Oregon has unique interests. Washington and the Indian Tribes are sympathetic and supportive of our concerns. But, they may not have the same degree of concern on issues important to Oregon.

A substantial grant increase would be necessary to give Oregon the necessary capability to do the independent site evaluations that are needed in Oregon.

Questions from Senator Hatfield

1. The State of Oregon has been concerned about Hanford operations for many years. How has Oregon dealt with the citizen concerns?

   The Oregon legislature registered its concern about Hanford operations in 1959. With help from a Public Health Service grant and the Legislature, monitoring of the Columbia River began in 1961. It continues today.

   In 1983 Oregon formed a Hanford Technical Review Committee to begin addressing Oregon's concerns with a potential repository and existing defense wastes. In 1985 the Hanford Advisory Committee was formed. This 32 member citizen group advised the Oregon Department of Energy on Hanford issues until July 1987. Through these committees, Oregon has developed positions on the repository, defense wastes, and N-Reactor.

   The 1987 Oregon Legislature passed a bill to establish a Hanford Nuclear Waste Board. It will be composed of Legislators and key executive agency appointees. A citizen advisory group will also be formed to advise the Governor on Hanford.

   Oregon voters overwhelmingly voiced support for the state opposition to the Hanford repository in May 1987.

2. What are Oregon's interests in Hanford besides the past contamination of the Columbia River?

   - Oregon has devoted a substantial amount of resources to evaluate the impacts of US DOE activities at Hanford on public health and safety. Our major concerns are the repository, existing defense wastes, and N Reactor. Our recent reports on N Reactor safety and defense wastes are enclosed for the record.

     More important than past contamination of the Columbia River is the potential future contamination of Oregon groundwater. Leaks from a repository or defense wastes at Hanford could reach Oregon groundwater and the Columbia River. This would be devastating to public health and safety of Oregonians.

     There will also be added risks imposed on us by the increased transport of high-level radioactive wastes. Shipments to or from Hanford will travel farther on Oregon highways than on Washington's.

     Oregon is also involved in the following issues:

     - studies of health effects from past radiation releases
     - decommissioning of old facilities at Hanford
     - transport and disposal at Hanford of decommissioned submarine reactors

- transport and disposal at Hanford of low-level waste
- emergency preparedness for accidents at Hanford.

3. Could you estimate the costs that the State of Oregon has had to bear with regard to the proposed repository at Hanford and the extent of Oregon's activities?

   Oregon has spent millions of its dollars to address Hanford issues, including the repository.

   Monitoring of the Columbia River has been done since 1961. This monitoring has cost tens of thousands of dollars per year. We pay for this. Monitoring will continue, and Oregon will continue to pay for these studies.

   The state has been involved in the repository issue since 1980. Nuclear Waste Policy Act negotiations and state review were a big part of our early work. Oregon received no support for these efforts until late 1985. At that time the State of Washington supported a year long joint review with $100,000. This helped. But, Oregon paid the difference. The total cost for 1986 repository work was about $250,000.

   In addition, some $200,000 of state funds has been spent on Hanford repository litigation since May 28, 1986. In all, over $1 million will likely be spent by the end of 1989 on attorney costs alone. Technical support for the litigation will be in addition to these costs. US DOE forced Oregon into litigation with the May 28, 1986 decision. These funds should be used more constructively. But we must oppose a flawed process.

   Nearly all of our work on defense wastes has been paid for by Oregonians. And, all of our work on N reactor and the other Hanford issues comes out of state funds.

4. What would be the State of Oregon's reaction to a Monitored Retrievable Storage (MRS) facility being located at Hanford?

   Oregon could support a MRS at Hanford only with conditions. First, it should be used to store and process existing defense wastes already at Hanford until they can be shipped for permanent disposal. Second, commercial waste at Hanford should be limited to that from the Northwest Low Level Radioactive Waste Compact States. This would limit the MRS facility at Hanford to receiving wastes from existing nuclear plants only in Oregon and Washington, thereby minimizing the transportation impacts. The concept behind the compact is valid for both low-level waste and high-level waste. Each region should manage its nuclear waste to share the burdens and reduce transport risks.

   Most other regions of the country have formed their own low level waste compacts. They should be responsible to develop MRS sites in their compact regions.

MWG:MLB:lkb/4111M (d2, f3)/8/13/87

NEIL GOLDSCHMIDT
GOVERNOR

Department of Energy

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July 22, 1987

The Honorable Mark O. Hatfield
United States Senate
Room 711 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Hatfield:

Thank you for the opportunity to testify last week on behalf of Governor Neil Goldschmidt in favor of Senate Bill 1007. That bill is very important to the State of Oregon and we strongly support it.

I would like to take this opportunity to provide you some additional information on the questions you asked me at that hearing regarding Oregon's involvement and review of Hanford issues. These may be useful for you in either supplementing the record or in further discussions with other members of the committee as the bill is going forward.

First, the Oregon Department of Energy has devoted a substantial amount of resources to evaluating the impacts on public health and safety of USDOE activities at Hanford, including defense wastes, N Reactor and the nuclear waste repository. Governor Victor Atiyeh requested that we do an analysis of the N Reactor after the Chernobyl accident of last year. We did so and we did a follow up comparison of where the N Reactor does and does not meet US DOE's proposed improvements to determine our requirements. Our conclusions are that N Reactor still must be further improved beyond what US DOE has planned in order for it to operate with the degree and confidence of safety we have from commercial or nuclear reactors. Without these improvements, the reactor should not be allowed to operate. I have enclosed a copy of both reports for your information.

The defense wastes have been a long standing source of concern to the State of Oregon. Your personal efforts have been essential to assuring appropriations to begin clean-up efforts. I have enclosed a copy of our report on defense wastes. The failure to clean those defense wastes up continues to cast credibility on the US Department of Energy and its ability to undertake any significant new projects at Hanford without causing grave concern to Oregonians.

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Third, with respect to the Nuclear Waste Repository, Oregon was extensively involved in the negotiations of the Nuclear Waste Policy Act and has had ongoing efforts for state involvement and state review since then. I have enclosed a chronology which outlines the state's efforts and the efforts of our advisory committees. The first committee is the Hanford Advisory Committee, composed of citizens. The second is the Hanford Review Committee, composed of technical state agencies which are reviewing the site. In addition, Senate Bill 13 which was passed by the 1987 Oregon Legislature establishes a Hanford Nuclear Waste Board, which will be composed of Legislators and key executive agency appointees and will advise the Governor directly on energy policy regarding Hanford.

SB 405 overwhelmingly passed in a referendum of Oregonians this past May, receiving some 70% of the vote. Among other provisions it urges support for the legislation that you introduced to grant Oregon affected state status. I have enclosed a copy of that legislation.

With respect to costs that the State of Oregon has incurred already in its efforts. I have some more precise information on attorney's fees. Some $200,000 was spent in the last eight months of the current biennium on Hanford litigation. Our attorneys will request an additional $650,000 this next week from the Legislative Emergency Board for the 87-89 biennium. In all over $1 million will have been spent by the end of the 1987-89 biennium on attorney costs alone. Technical support by my agency and other state agencies for the litigation will be in addition to these costs.

I would also like to expand briefly on why SB 1007 is extremely important to Oregon in spite of the cooperative efforts we have with the U.S. Department of Energy right now. Mr. Rusche and his staff, particularly at the Richland Operations Office, personally have been very gracious and generous with their time in working with the State of Oregon. Nevertheless, while they have been personally responsive to our requests for information, Oregon does not have the status that affected states have.

The important differences that "affected state" status would bring are the following:

1. The ability to approve or disapprove the site. The State veto and the ability to present to Congress arguments on why a site should not be located are essential for Oregonians to have adequate representation on the issue. Washington has this ability, but the State of Oregon, where more than 1 million people live on the Columbia River, does not have this ability.

2. Economic assistance. Oregon has received, for the first time this year, a grant of approximately $500,000 to review the site. While this money will enable us to do a minimal evaluation of US DOE's activities, it is not anywhere near the amount of money the State of Washington and affected Indian tribes are receiving. The Indian tribes are receiving on the average of $2 million a year.

Washington's grant has increased from $2 million per year to more than $5 million per year since site characterization studies have begun at Hanford. While the issue is not simply what amount of money each state receives, nevertheless, the amount of money that the state receives indicates whether or not it will have the ability to work effectively on a detailed technical evaluation of US DOE's efforts. Given the controversy that has occurred around US DOE's efforts so far, independent evaluation by the states and Indian tribes is essential. Oregon has unique interests, and while Washington is sympathetic and supportive of our concerns, Washington may not necessarily have the same degree of concern on issues important to Oregon. It is essential that Oregon have the necessary capability to determine the independent evaluations that are needed in Oregon regarding the site.

3. US DOE's budget request for FY 1988 opposes Oregon's existing grant. US DOE's FY 1988 budget request urges termination of our existing grant. The proposed budget request shows a deobligation of $500,000 for fiscal year 1988. This is the amount which the State of Oregon would otherwise receive. (See page 473 of Volume 2 of the Congressional Budget Request, U.S. Department of Energy, January, 1987.) US DOE's explanation is simply "deletes language contained in Public Laws 99-500 and 99-591 which had specific application to fiscal year 1987".

   Affected state status will ensure Oregon of continuing ability to participate in meaningful technical reviews of Hanford and not be subject to the whims of U.S. Department of Energy's budget process and budget request.

Thank you for your strong support of sponsorship of SB 1007 and for your efforts to be able to protect the interests of the State's citizens on the Hanford issues. Also thank you for the personal courtesy you showed me during the hearing. If there is anything we can do to assist you further in this effort, please do not hesitate to have your staff contact me.

Sincerely,

Michael W. Grainey
Deputy Director

MWG:ja
61650(d1-f1)

Enclosures

cc: Stephen Crow
Mark Walker

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION RESPONSE TO QUESTIONS FROM SENATOR JOHNSTON

Hearing on July 16, 1987

1. The Confederated Tribes of the Umatilla Indian Reservation have received $2.8 million in grant funding from DOE since 1983.

ANSWER. We are unaware of where you received the $2.8 million figure. During the years 1983 through 1986, the Umatilla Nuclear Waste Study Program received grant funds in the amount of $1,898,000.00

1. a. What level of funding did the tribe receive in fiscal year 1986?

ANSWER. $1,025,000.00.

1. b. How much funding have you asked for or received thus far in the fiscal year 1987?

ANSWER. We initially requested $2,445,000.00 for FY 1987. Our grant amount for the grant year was not finalized until July, the 10th month of the fiscal year. The grant was for $1,748,000.00.

1. c. Please tell us the major activities carried out by the tribe with this funding?

ANSWER. Significant accomplishments under the tribe's Nuclear Waste Policy Act program include:

(1) Increased management expertise through continued training of staff, additional staff being hired, and increased computer capabilities which have facilitated the effective management of the program.

(2) Continued acquisition of technical and professional services through contracts to perform the technical and legal review of DOE documents.

(3) Continued participation and training of the advisory

committee which was organized at the tribal policy level and is composed of key tribal officials which have closely followed the tribal nuclear waste program and advised staff on initiatives and issues.

(4) Continuing participation in the many technical and policy-level nuclear waste meetings between the affected Indian tribes, the states, DOE, and the NRC.

(5) Prepared for and participated in C & C negotiations for two years. Worked to resolve the issues identified by the CTUIR as being a barrier to further C & C negotiations and conducted negotiating team training.

(6) Enhancement of the Public Information Program which disseminates information to the tribal membership by organizing informational meetings, publishing newsletters, establishing an on reservation nuclear waste related library/reading room, and production of multimedia communications.

(7) Initial implementation of the Tribal Environmental Assessment Plan through the hiring of key staff and beginning the development of a tribal methodology to perform assessments of possible environmental impacts of potential release scenarios.

(8) Initial implementation of the tribal Socioeconomic and Cultural Plan through the hiring of key staff and beginning the acquisition of baseline socioeconomic and cultural data.

(9) Establishment and continued operation of the on-site

office in Richland, Washington, which has provided increased ability to participate in the site characterization activities.

(10) Reviews were accomplished and comments were provided on the draft SCP chapters.

(11) Participated in the evaluation of and prepared necessary comments representing tribal concerns with several official documents released by DOE, GAO, NRC for review and comment.

(12) Participation with other tribal, state and local governments in an attempt to encourage and establish needed intergovernmental relations.

2. Grant funding given to states and tribes for independent review has been a continual bone of contention between DOE and the states or tribes.

ANSWER. The grant funding from DOE has been a contentious issue for some time. DOE has been slow to provide funding and persists in unnecessary meddling in the administration of our grant. It appears DOE has had an exceedingly difficult time coming to grips with the independent oversight authority of affected parties.

The delays in funding have been unreasonable and damaging to our program. We submitted out initial FY 87 grant proposal to DOE in August, 1986. DOE did not finalize our grant until July, 1987, ten months into the fiscal year.

DOE promises to improve the grant approval and distribution process this year by expediting their review. The Umatilla Tribe is hopeful the situation improves. The responses below are relevant to the timetable for FY 1988.

2. a. When do you send request to DOE?

ANSWER. We sent our FY 88 grant proposal to DOE on July 8, 1987.

2. b. Are these requests sent to DOE prior to the time when the Department formulates its own overall budget to allow the request to be easily factored in?

ANSWER. In April, 1987, we sent DOE our grant projections for FY 88-90. Presumably the projections were built into DOE's budget formulation.

2. c. Do you think it is fair to expect that all grant requests are honored, even if honoring those requests means that the field office must dip into its own operating budget?

ANSWER. It depends upon the activity involved. In any event, we are not aware of DOE's Richland office ever having to make such a decision.

2. d. Do you think it would be appropriate for Congress itself to act on each grant request, as part of the overall appropriations process?

ANSWER. The only reason for Congress to assume the responsibility for administering the grants to affected parties would be because of DOE's malfeasance. If there is no improvement under DOE"s new grant schedule, some alternative would certainly be appropriate.

2. e. Would you be able to tell us right now what level of grant funding you expect to be necessary for fiscal year 1988?

ANSWER. Yes. As previously mentioned, we submitted our 125 page FY 88 grant proposal on July 8, 1987.

3. There is currently an on-site representative from the Nez Perce Indian Tribe at the Hanford Reservation.

-- Has DOE offered the same opportunity t the Umatilla Tribe?

-- Do you plan to have an on-site representative?

ANSWER: The Nez Perce on-site representative referred to in your question and during the hearings was put at Hanford by both the Umatilla and the Nez Perce Tribes. Both tribes share the same representative.

4. You state in your testimony that the nuclear waste program is in such a state of disarray that the only thing left to do is to place a temporary moratorium on all activity and establish a study commission.

4. a. Aren't you concerned that the practical effect of this would be to repeal the Nuclear Waste Policy Act and delay the solutions to the problem of nuclear waste disposal for years?

ANSWER. No. Actually the scenario you present is much more likely if DOE's repository program is allowed to continue.

Concern about a moratorium bill effectively repealing the NWPA, in that Congressional action would be required to resume repository activity, could easily be cured by provision calling for an automatic restart of the program within a limited time period following the submission of the commission's report to Congress.

The Umatilla Tribe does not support the moratorium approach to delay the nation's search for solutions to the nuclear waste disposal issue. With the large volume of high-level defense wastes at Hanford, some contained in leaking single-walled tanks, the Tribe has no interest in delaying the safe, permanent disposal of these wastes.

Rather, in supporting the moratorium and commission review, we seek to expedite the search for a safe, permanent solution to the nuclear waste problem. We do not feel that objective, which

Congress clearly established in 1982, can be achieved by DOE's present program. Nor do we think that allowing DOE to select one site for characterization is going to achieve that objective. The moratorium is needed to permit the commission to suggest corrective action to remedy the glaring defects in DOE's program. Under H.R. 2967, the commission report would be due in 12 months. That delay would be no greater than that proposed by Senator Johnston in S. 839, as amended, whereby the selection of a site for characterization would not be made until January, 1989. In fact, a central concern to those supporting S. 839 as amended ought to be the potential delays that approach may involve. If the first site selected is judged unsuitable or fails to be licensed, there would be a lengthy delay before characterization could begin and be completed at the second site. In our view, the potential for delay is much more a factor in S. 839 than in the moratorium approach.

4. b. What makes you think that a study commission will help us to reach a new consensus on how or where to dispose of nuclear waste?

ANSWER. We do not think that a commission will help the Congress decide how or where to store nuclear wastes. We support the commission review to evaluate DOE's implementation of the repository program. The issues that need to be addressed include the adequacy of the siting guidelines, Environmental Assessments and site selection methodology. The consultation with affected parties also needs review.

The product of the commission's report will not be to suggest which sites are better, but to suggest a fair process that will produce superior sites.

4. c. Isn't a moratorium and study commission just a glorified way of postponing controversial decisions on nuclear waste?

ANSWER. No. It is designed to insure that those decision are based on a sound, technical basis, and are therefore, less controversial.

4. d. Isn't the coalition supporting a moratorium and study commission really a coalition of people that fear that nuclear waste will end up in their state?

ANSWER. Congressman Morris Udall does not fit that description.

4. e. Isn't a moratorium and study commission just a cop out?

ANSWER. No. But we think many of the proposals that would abandon the NWPA framework fit that description. We support the moratorium because we want the NWPA to work.

4. f. Are you concerned at all that a moratorium will drive away competent technical people from the nuclear waste program?

ANSWER. The Umatilla Tribe supports the language in the Sasser bill providing for continued funding for affected parties so we could maintain our staff and consultants during the moratorium. We feel the experience and expertise of our staff, and those of the other affected parties, would be of great assistance to the commission in developing solutions to the repository program. Such a funding provision would prevent the loss of our technical people.

As for DOE, the time to implement a moratorium is now, prior to hiring the technical experts needed for site characterization and prior to selecting the system's engineering and development contractor. The moratorium approach certainly presents no greater threat to the loss of competent technical personnel than does S. 839, as amended. If the first site selected for characterization fails, consider the time and difficulty involved in collecting a competent technical team to undertake characterization at the second site.

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION RESPONSE TO QUESTIONS FROM THE MINORITY

Hearing on July 16, 1987

1. You state that the NWPA should not be abandoned, yet that is precisely what Udall's and Sasser's bills (which you say you support) would do. Their moratorium essential guts the NWPA, and nothing restarts unless Congress passes new legislation. Please explain this inconsistency in your policy position.

ANSWER. There is no inconsistency in our policy position to explain. The Umatilla Tribe does not support the moratorium bills to gut the NWPA. As we have stated, we are prepared to participate in a repository program executed in a manner consistent with Congress' intent when the Act was enacted. DOE's complete failure in developing such a program has not led the Tribe to support various proposals that would dramatically alter the NWPA framework. Instead, we remain committed to the NWPA framework properly implemented. That framework calls for technical merit to be elevated over political and programmatic expediency, a technical program that is conservative rather than "overly optimistic, and a program that fully incorporates consultation and cooperation with affected parties.

We recognize the concern the question presents. The Umatilla Tribe would have no objections to language requiring an automatic restart of the existing program in the absence of congressional action within a limited time period following the report by the commission. However, we feel that on the basis of the commission's report, the Congress would conclude,as we have, that it is not the NWPA that has failed, it is DOE's implementation of their responsibilities under the Act that has brought the program to its knees. It is DOE's program that needs to be gutted so that safe nuclear waste facilities can be sited and constructed in a manner that does not ignite hostile opposition by host communities and governments.

2. If site characterization were to proceed at the Hanford site, what would be needed (in terms of independent oversight, etc.) to restore your confidence in the technical credibility of the work?

ANSWER. Given the NRC comments on the Hanford Environmental Assessment and DOE's Licensing Assurance Review Team comments on the site characterization plan (SCP) for Hanford, it is clear DOE's work to date lacks the conservatism needed in a project to build a facility for the permanent disposal of high-level nuclear wastes. The NRC found many of DOE's favorable findings at Hanford "overly-optimistic". Concerning site characterization planning, the NRC warned:

> "The significance of the above concerns [DOE's optimistic assessment of site performance] is to DOE's ongoing preparation of the SCP's and eventually to site characterization activities, since both the general over optimism as well as the specific concerns could result in inadequate testing programs and inadequate information at the time of licensing."

[Emphasis added.]

Our preliminary reviews of the draft SCP chapters and the comments of DOE's own SCP peer review team, the Licensing Assurance Review Team, indicates the NRC warning has not had much impact on DOE. DOE plans and assumptions in critical areas affecting the waste containment capabilities of the Hanford site remain optimistic and they fail to conservatively assess the available data.

Another example of DOE's planning that has been severely criticized by an independent review concerns DOE's Hanford plan for the research and protection of cultural and archeological resources. This is an area of special concern to the Umatilla Tribe as Hanford sits on aboriginal territory of the Tribe and Hanford is known to contain a large number of cultural and archeological sites and resources that are sacred to tribal members. DOE's cultural plan was reviewed by Thomas King, Director of the Advisory Council on Historic Preservation's Office of Cultural Resources. Mr. King concluded:

> "I think the document can be summarily evaluated as next to useless, and perhaps even less than useless, since if the direction it provides (to the extent it provides any) were followed, DOE would find itself engaged in the mutually contradictory processes of seeking to comply with Section 106 of the National Historic Preservation Act on both case-by-case and programmatic bases."

In light of DOE's past performance at Hanford, we initially question whether DOE should continue in its lead role in implementing the NWPA. One reason we support the moratorium bills introduced by Senator Sasser and Congressman Udall is because the commission established by each bill would study this issue.

Whichever agency conducts site characterization should have their activities independently reviewed by affected states and tribes and by an independent panel of experts established under the aegis of the National Academy of Sciences or some other such body of independent, scientific expertise. The Umatilla Tribe supports in principle, the function of the peer review panels presently planned for each of the three sites by the NAS.

In addition, each affected party should be entitled to oversee any of DOE's site characterization activities to insure their interests are protected. In recent months, DOE has refused entry or expelled members of our staff or our consultants from their meetings. The NRC on-site representative at Hanford, Bob Cook, has also had considerable difficulty getting access to DOE meetings, personnel and data. An NRC report released last February on their on-site representative program concluded: "Interactions with DOE and DOE Project representatives have been the least effective at BWIP [Hanford] where the OR [on-site representative] has been restricted from access to some draft information, select meetings and other interactions with various DOE Project representatives." DOE must recognize that the affected parties need to be brought into the process as participants, not excluded as adversaries.

3. You express concern about regional MRS facilities becoming de facto repositories. Would tangible progress on first repository siting in parallel with MRS construction allay your fears?

Yes.

REPLY OF NEZ PERCE TRIBE TO QUESTIONS OF SENATOR JOHNSTON

Committee on Energy and Natural Resources
July 16, 1987 Hearing

Question 1. The Nez Perce Tribe has received $2.8 million in grant funding from DOE since 1983.

-- What level of funding did the tribe receive in fiscal year 1986?

-- How much funding have you asked for or received thus far in fiscal year 1987?

-- Please tell us the major activities carried out by the tribe with this funding?

Answer In 1986 the DOE required the Tribe to switch from a fiscal year funding basis to a calendar year basis. This switch caused the anomaly of a fifteen month funding period of fiscal/calendar 1986; funding for the period was $1,308,023. The calendar 1987 request was for $2,734,732, of that $2,236,346 has been received. Total funding since 1983 has been 3.9 million dollars.

We have submitted under separate cover [attachment to April 29, 1987 testimony before the Committee] a detailed statement describing our program activities.

Question 2. Grant funding given to states and tribes for independent review has been a continual bone of contention between DOE and the states and tribes.

-- When do you send requests to DOE?

-- Are these requests sent to DOE prior to the time when the Department formulates its overall budget to allow the request to be easily factored in?

-- Do you think it is fair to expect that all grant requests are honored, even if honoring those requests mean that the field office must dip into its own operating budget?

-- Do you think it would be appropriate for Congress itself to act on each grant request, as part of the overall appropriations process?

-- Would you be able to tell us right now what level of funding you expect to be necessary in fiscal 1988?

Answer In the first quarter of every calendar year DOE requests, and we provide, a three year projection (estimate) of funding requirements. On or before August 30th of each year a funding request for the following calendar year is provided to DOE. This is DOE's timetable and we have always been timely; we must therefore assume that DOE would request data from us in a timeframe that allows it to meet its internal and external timelines. We are unaware of any budgetary conflict between the affected tribes and DOE field offices. Tribal grants are a minuscule part of the DOE budget and an infinitesimal factor in the enormous cost explosion surrounding the the NWPA. It is our impression that the NWPA contemplated that DOE administer the grant aspect of the Program. There have been problems, particularly with lateness of grants, with DOE's performance. Whether Congress through the appropriations process would wish on an annual basis to replace DOE and make the detailed grant decisions required, seems quite unlikely. Enhanced oversight, such as been prevalent lately seems to have had some positive effect on DOE's performance in the grants area.

Our grant request for calendar 1988 is $2,956,827.

Question 3. There is currently an on-site representative from the Nez Perce Tribe at the Hanford reservation.

-- Are you allowed full access to DOE officials and contractor personnel?

Answer We were very careful to select an on-site representative who could work effectively in the Hanford environment. Our representative is a PHd with a background in engineering and nuclear physics. He previously worked for the Pacific Northwest Laboratory and was well acquainted with DOE. He has a Q security clearance. Although there were some initial coordination issues, those have been resolved, and the day-to-day working relationship and access with Hanford personnel is adequate.

Question 4. You state in your testimony that the nuclear waste program is in such a state of disarray that the only thing left to do is to place a temporary moratorium on all activity and establish a study commission.

-- Aren't you concerned that the practical effect of this would be to repeal the Nuclear Waste Policy Act and delay solutions too the problem of nuclear waste disposal for years?

-- What makes you think that a study commission will help us to reach a new consensus on how or where to dispose of nuclear waste?

-- Isn't a moratorium and study commission just a glorified way of postponing controversial decisions on nuclear waste?

-- Isn't the coalition supporting a moratorium and study commission really a coalition of people that fear that nuclear waste will end up in their state?

-- Isn't a moratorium and study commission just a cop out?

-- Are you concerned at all that a moratorium will drive away competent technical people from the nuclear waste program?

Answer As our testimony indicated, we do not favor an indefinite moratorium that would require an affirmative act on the part of Congress to restart the nuclear waste program. We have consistently favored a automatic restart provision coupled with a requirement of a nationwide search for repository sites.

The questions above clearly call into issue whether a study is an appropriate response to the problems that have been raised. In our view, evidence of DOE's "can do" or non-conservative approach, coupled with its political, non-scientific decision-making, may be indicators of systemic problems. It is far better to address these issues now when corrections are easily made, than after a repository is in the ground. Far too often often our national commissions and studies are after the fact. An unfortunate analogy is the recent report on the space program, where a combination of factors, including political pressure to meet deadlines and on over aggressive "can do" attitude converged to produce tragic consequences. In effect, the study was too late.

If the views of the proponents of the Commission approach were simply political, the sequential proposal (S. 1668) which is so clearly geared to only one site should have generated the active support of the States and Tribes concerned with the other two sites. Such is not the case; none of us have supported S. 1668.

FOLLOWUP QUESTIONS FOR SOL BURSTEIN
Hearing on Pending Nuclear Waste Legislation
July 17, 1987

From Senator Johnston

Reprocessing

1.Q. Testimony was given on July 16 that left the impression that reprocessing spent fuel would result in a significantly lower volume of waste to be disposed -- one witness indicated that as much as 95 to 97% of the spent fuel could be re-used and, thus, not require disposal.

Is this an accurate statement?

According to written testimony received from the Federation of American Scientists, the total volume of radioactive waste to be disposed would actually increase with reprocessing. Although the volume of solidified high-level waste would be less than that of spent fuel, they said that the total volume of radioactive material produced during reprocessing and plutonium fuel fabrication would be significantly greater.

In your opinion, how would reprocessing affect the volume of waste to be disposed? Would there be more or less radioactive waste requiring disposal?

A. Any given nuclear fuel element has a finite usable lifetime that is determined by reactor design, core physics, and economic considerations. Nuclear fuel designers can control usable lifetime, within limits, by adjusting new fuel design parameters, such as uranium enrichment. Generally, the end of usable life is reached when the nuclear chain reaction in the fuel element is retarded by depletion of some of the fissionable material and by the build-up, within the fuel itself, of high-level radioactive waste, formed in the chain reaction, that acts to "poison" the chain reaction. Reprocessing spent nuclear fuel is the process by which the usable fuel still contained in the fuel element is removed for reuse. The decision of whether or not the commercial industry will reprocess is largely an economic one that also must take into account federal policies and the availability of a reasonable reprocessing regulatory regime. Nuclear waste disposal is neither helped nor hindered by reprocessing. Congress recognized this when it passed the Nuclear Waste Policy Act of 1982. The disposal program envisioned by the Act is required to dispose of either spent fuel or high-level waste from reprocessing. Whether this nation will develop commercial reprocessing is left up to the private sector. To date, questionable economics, and uncertainties in government policy and regulations have prevented any commercial reprocessing proposal in the U.S. from gaining supporters. When, and if, this situation changes, the industry may pursue the reprocessing option. To require reprocessing as a step before disposal is unwarranted, tremendously expensive and will unnecessarily embroil the nation in yet another impassioned nuclear policy debate.

Reprocessing removes about 96% by weight of the spent fuel in the form of uranium and plutonium, both of which could be fed back into the nuclear fuel cycle for fueling power reactors. However, the same amount of high-level by-product waste must be disposed of whether or not the uranium and plutonium are separated. This high-level by-product waste is the predominant heat generator that controls the design of the repository. High-level waste will be vitrified, i.e., diluted and solidified with glass, prior to disposal. The volume of the glass with the high-level waste is not significantly different from the volume of the original spent fuel. Also, reprocessing is a chemical process that generates its own wastes and subsequent fuel fabrication using plutonium also generates radioactive wastes. In addition to the high-level radioactive waste, reprocessing and plutonium fuel fabrication produce transuranic wastes (waste containing uranium or plutonium) and low-level radioactive waste. All told, reprocessing actually results in a total volume of waste that is greater than the volume of the original spent fuel. But, this is only a minor consideration for deciding whether or not to reprocess as compared to the other concerns expressed above.

Q. What would be the difference in the radioactive content of waste products resulting from reprocessing and the radioactivity from spent fuel that has not been reprocessed?

A. The difference in radioactive content between high-level waste resulting from reprocessing and that of unreprocessed spent fuel is, from a disposal perspective, very small. Reprocessing removes the large amount (by weight) of the usable uranium and plutonium, but these elements contribute a small part of the total radioactivity and heat generation. The radioactive elements that control waste disposal system design are the shorter half lived, ie, higher energy and higher heat producing radionuclides that are retained in the high-level waste derived from reprocessing.

Q. **Is there any value to recovering any of the shorter-lived isotopes in spent fuel?**

A. A number of shorter half life isotopes, which are contained in the high-level waste extracted during reprocessing, have some small commercial value for a limited amount of material as a possible source of radiation for such activities as sewage sterilization or insect control in bulk storage. These materials would only be considered by-products and the economic benefit from their production would not provide sufficient additional valve to make spent fuel reprocessing itself economically attractive. The extraction of shorter half-life isotopes for applications where high purity is required, such as for medical or research uses, is unlikely to be economical compared to other means of producing such materials.

2.Q. How would reprocessing affect the spacing required for placement of waste in a repository?

At the July 16 hearing, one of the witnesses suggested that reprocessing could reduce the amount of space required by as much as 20 to 30%. Would this make for a significant difference in the size or cost of a repository? Wouldn't any cost savings be offset by the cost of packaging and vitrifying the high-level waste resulting from reprocessing?

A. Final repository design will determine the placement of wastes in the repository. Final design cannot proceed until the information is collected from the repository host rock body at depth during site characterization. Therefore, it is not possible to state with any certainty the space required for either spent fuel or the high-level and transuranic wastes from reprocessing. There are several factors that control spacing of waste in the repository: heat generation rate, total heat generated, nuclear criticality, mine safety considerations and the retrievability requirement. At this time, it appears that with or without reprocessing the underground space requirements will be about the same. Since these designs are not yet known, it is not possible to say with any certainty at this time whether the costs of high-level waste vitrification and packaging, plus packaging the transuranic waste, will be more or less costly than packaging spent fuel for disposal. The repository underground mining costs are small compared to the overall program (about 10%). Therefore, reprocessing would add an unknown, but considerable, cost to waste disposal, and would not be justified by savings that may, or may not, be obtained in the waste disposal system.

3.Q. Testimony was given July 16 to the effect that there is no logical reason not to reprocess commercial spent fuel since we reprocess spent fuel resulting from defense operations. Testimony stated that we must rethink the rationale that led to the Carter Administration's ban on commercial reprocessing in 1977.

But isn't it true that the main reason for not now reprocessing commercial spent fuel in the U.S. is economics?

Isn't it true that disposal of spent fuel without reprocessing is a lower cost option that reprocessing prior to disposal?

A. This question is largely answered above. Since reprocessing is neither a help nor hindrance to disposal, it must stand on its own and be justified as described in answer to question 1. Reprocessing for defense purposes is carried out not for waste disposal but for reasons related to the defense nature of the operation in the first place. In 1981, President Reagan lifted the ban on commercial reprocessing imposed by former administrations. However, nuclear fuel economics and uncertainty regarding federal policy and regulations concerning reprocessing have contributed to the lack of private sector interest in commercial reprocessing. If reprocessing, were to be required for the purposes of disposal then the net cost of reprocessing would be added to the cost of disposal. Under the current economic conditions, uranium and plutonium recovered from spent fuel would have a market value much lower than the cost of recovery. Therefore, the net cost of reprocessing would increase the cost of disposal, probably by a large amount today and into the foreseeable future.

Long-Term Storage

1.Q. At the July 16 hearing, the Department of Energy testified that the greatest reduction in the heat of spent fuel occurs during the first 20 to 25 years after discharge. The Department's testimony included figures estimating that 60% of the heat is lost during the first 10 years after discharge and that 90% is lost after 25 years.

Do you agree with these figures?

A. DOE's figure's are approximately correct.

2.Q You stated in your testimony that essentially all the technical advantages of long-term storage before disposal would be achieved with a 20-year cooling period.

Would it be prudent to require that spent fuel be stored for 20 years prior to disposal?

A. In our testimony, the twenty year period referred to the minimum spent fuel age at time of disposal during the first ten years of repository operation. We calculated this based on available DOE data and DOE's admittedly optimistic schedule. It is not hard to imagine that the minimum age will rise to 25 years by the time disposal actually begins. One of the key parameters in high-level waste disposal is the amount of heat generated by the waste. As seen in the question above, this parameter falls off to 90% of its initial value after 25 years. A specific storage period requirement does not appear to be needed and would make the disposal system less flexible and less able to respond to changes. DOE plans to design the repository such that underground expansion will be accomplished incrementally to accommodate differing ages of spent fuel and to take advantage of different heat generation rates; this makes sense. The MRS would provide additional flexibility by providing a location at which DOE could mix and match fuel ages to maximize repository efficiency.

3.Q. Dr. Alvin Weinberg included a chart in his testimony before this committee indicating the difference in heat load based on the age of spent fuel.

Do you agree with the figures included in Dr. Weinberg's chart?

A. As I indicated in my testimony, I agree with the figures in Table 1 of Professor Weinberg's statement.

Q. Please tell us the difference in radioactivity between 10-year old fuel and 50-year old fuel. Is the difference substantial?

What about the difference between 25-year old fuel and 50-year old fuel?

A. The radioactivity of 50 year old spent fuel is approximately 12% of 10 year old spent fuel and 45% of 25 year old fuel. For reference, the radioactivity of 25 year old fuel is 30% of 10 year old fuel. While these differences appear to be substantial, they do not necessarily have a comparatively significant impact on the overall waste disposal program effectiveness or cost.

Q. Do the differences in heat and radioactivity make it prudent to require long-term storage prior to geologic disposal?

What can you tell us about the cost differential, in terms of repository design, size, etc.?

A. As discussed above, the primary advantages of storage prior to disposal will be realized simply because of the delays inherent in DOE's currently planned schedule. Also, it is not prudent to require a specific, extended storage period for the reasons stated above.

4.Q. Dr. Weinberg stated during the July 17 hearing that the heat load from 2.3 times 70,000 MTU of 50 year old spent fuel would be approximately equal to the heat load from 70,000 MTU of 10 year old spent fuel (reference to the chart on page 2 of Weinberg testimony).

But does it then follow that you could store approximately 160,000 MTU of 50 year old spent fuel in the same space as 70,000 MTU of 10 year old spent fuel?

If not, why not?

A. As stated in answer to a question above, there are a number of factors that control spacing of spent fuel in the repository and actual emplacement parameters can not be determined until the final repository design is developed. While, by simple mathematics, the heat generation rate from 70,000 MTU of 10 year old spent fuel equals the heat generation rate of 160,000 MTU of 50 year old spent fuel, it does not follow that 160,000 MTU of 50 year old spent fuel can be disposed of in the same repository space as 70,000 MTU of 10 year old spent fuel. Other factors come into play, such as the total heat generation over time following emplacement, nuclear criticality, mine safety considerations and retrievability that lead, in combination, to greater spacing requirements. Missing from Professor Weinberg's statement is that spent fuel cooling begins at the time of removal from the reactor. Consequently, 60% of the total heat is dissipated during the first ten years and an additional 30% by 25 years. Therefore most of the heat (90%) will be dissipated by the time DOE actually disposes of the spent fuel. However, we believe for the reasons stated above, that a specific storage requirement is unnecessary and may hinder the program.

FOLLOWUP QUESTIONS FOR ALVIN WEINBERG

Hearing on Pending Nuclear Waste Legislation
July 17, 1987

From Senator Johnston

Reprocessing

1. Testimony was given on July 16 that left the impression that reprocessing spent fuel would result in a significantly lower volume of waste to be disposed -- one witness indicated that as much as 95 to 97% of the spent fuel could be re-used and, thus, not require disposal.

--Is this an accurate statement?

--According to written testimony received from the Federation of American Scientists, the total volume of radioactive waste to be disposed would actually increase with reprocessing. Although the volume of solidified high-level waste would be less than that of spent fuel, they said that the total volume of radioactive material produced during reprocessing and plutonium fuel fabrication would be significantly greater.

--In your opinion, how would reprocessing affect the volume of waste to be disposed? Would there be more or less radioactive waste requiring disposal?

--What would be the difference in the radioactive content of waste products resulting from reprocessing and the radioactivity from spent fuel that has not been reprocessed?

--Is there any value to recovering any of the shorter-lived isotopes in spent fuel?

2. How would reprocessing affect the spacing required for placement of waste in a repository?

--At the July 16 hearing, one of the witnesses suggested that reprocessing could reduce the amount of space required by as much as 20 to 30%. Would this make for a significant difference in the size or cost of a repository? Wouldn't any cost savings be offset by the cost of packaging and vitrifying the high-level waste resulting from reprocessing?

3. Testimony was given July 16 to the effect that there is no logical reason not to reprocess commercial spent fuel since we reprocess spent fuel resulting from defense operations. Testimony stated that we must rethink the rationale that led to the Carter Administration's ban on commercial reprocessing in 1977.

--But isn't it true that the main reason for not now reprocessing commercial spent fuel in the U.S. is economics?

--Isn't it true that disposal of spent fuel without reprocessing is a lower cost option than reprocessing prior to disposal?

Long-term Storage

1. At the July 16 hearing, the Department of Energy testified that the greatest reduction in the heat of spent fuel occurs during the first 20 to 25 years after discharge. The Department's testimony included figures estimating that 60% of the heat is lost during the first 10 years after discharge and that 90% is lost after 25 years.

--Do you agree with these figures?

2. You have suggested in previous testimony to this committee that long-term storage in the range of 50 years could be a good idea. The chart on page 2 of your July 17 testimony indicates the difference in heat load based on the age of fuel.

--Please tell us the difference in radioactivity between 10-year old fuel and 50-year old fuel. Is the difference substantial?

--What about the difference between 25-year old fuel and 50-year old fuel?

--Do the differences in heat and radioactivity make it prudent to require long-term storage prior to geologic disposal?

--What can you tell us about the cost differential, in terms of repository design, size, etc.?

3. You stated during the July 17 hearing that the heat load from 2.3 times 70,000 MTU of 50 year old spent fuel would be approximately equal to the heat load from 70,000 MTU of 10 year old spent fuel (reference to the chart on page 2 of your testimony).

--But does it then follow that you could store approximately 160,00 MTU of 50 year old spent fuel in the same space as 70,000 MTU of 10 year old spent fuel?

--If not, why not?

August 7, 1987

RESPONSE TO SENATOR JOHNSTON'S QUESTIONS

Reprocessing

The following tables of data are provided as background for responses to the questions about "reprocessing" and reprocessing wastes. Calculated characteristics of a typical (17- by 17-element) PWR fuel assembly, after having been irradiated to 33,000 MWd/MTU, are given in Table 1.

Table 1. Composition of a Spent Fuel PWR Assembly

Constituent	Weight (kg)	Wt. percent
Uranium	441.3	67.0
Plutonium	4.0	0.6
Fission products	15.7	2.4
Other Actinides	0.5	0.1
Hulls/hardware	135.0	20.5
Oxygen	62.2	9.4
Total	658.7	100.0

Notes: The radioactivity after 10 years decay is 3.94×10^{5} Ci.
The thermal power after 10 years decay is 1.14×10^{3} W.
The volume, based on overall outside dimensions, is 0.19 m^3.
The total electricity derived is 120 million kWh.

Table 2. Volume of Wastes from Reprocessing a Spent PWR Fuel Assembly (From Report DOE/RW-0006, Rev. 1)

Waste Stream	Volume (m^3)
Solidified high-level waste*	0.0412
TRU waste*	0.4818
Hulls/hardware*	0.1892
"Fixed" iodine*	0.0033
"Fixed" carbon-14*	0.0005
Krypton-85	0.0003
Low-level waste	0.5754
Total	1.292

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*These wastes require disposal in a deep geologic repository, or equivalent.

1. The statements as quoted here cannot be justified by the data of the above tables. The volume of reprocessing wastes destined for a high-level geologic repository is about 0.7 m^3 compared with the volume of 0.19 m^3 of spent fuel. The total volume of reprocessing waste, including that destined for shallow land burial is about 1.3 m^3, a factor of almost 7 greater than for spent fuel.

Of the 658.7 kg spent fuel, about 446 kg or 68% is uranium and plutonium. This material (68%) might be re-used. I do not see where 95-97% comes from, unless the witness was ignoring the hulls and hardware.

Thus,

-- Reprocessing would significantly increase the volume of wastes to be disposed of.

--The total radionuclide content of all the reprocessing wastes would closely approximate the total radioactivity of the spent fuel, less the radioactivity of uranium and plutonium that has been removed.
Thus, activity of SF at 10 y is 1.818×10^5 Ci at 10 y
activity of U and Pu is 3.737×10^4 Ci at 10 y
Activity of repro waste 1.444×10^5 Ci at 10 y

The activity of all repro wastes is $\frac{1.444}{1.818} = 79\%$ of that of SF @ 10 y.

--Many of the fission products have beneficial applications, especially ^{137}Cs, ^{85}Kr, ^{99}Tc; others have potential applications but have not penetrated the market in a major way. The problem has always been in separating and making them available at a cost that is competitive with alternative products. As a general rule, their chemicalseparation increases the volume and diversity of the residual wastes and thus complicates the overall waste management problem. Furthermore, the concentrated radiation sources still require final disposal after their radiation potential has been utilized! The most that can be said is that if the market is willing to pay for radionuclide separations and preparation, then such can be done. But there is little to be realized from simplified or reduced waste management requirements.

2. How would reprocessing affect repository spacing?

This is a complicated question whose answer can depend on the heat generation rate per unit volume of waste, the subsequent decay characteristics of the waste after emplacement, the design of the repository, and the characteristics of the waste package, itself. If one compares the total repository space requirements for disposal of SF vs. disposal of HLW-plus-other-reprocessing-wastes, I would guess that the requirements would not be significantly different. The very long-term heat pulse from the plutonium present in the SF would require more space than would the HLW (without Pu), but at the moment I know of no study that quantifies the difference in any meaningfully general way. I don't doubt but that one could describe a repository situation where a 20 to 30% reduction in space for HLW (only) vis-a-vis SF could be shown.

I shouldn't think that the cost of vitrifying and packaging HLW would be significantly different than conditioning SF, but in any case, the cost of HLW conditioning would be paid for by the reprocessor--even in Europe it is included as part of the cost of reprocessing.

3. Rethinking the rationale for reprocessing.

   Although reprocessing does indeed exacerbate the problem of Pu diversion and nuclear weapons proliferaiton, it is not clear to many of us how not reprocessing in the United States significantly affects the overall international proliferation situation. I think we agree that

   --The reason we are not reprocessing in this country now is mainly that reprocessing is not economic. Uranium is selling at virtually "give-away" level. Another reason, of course, is that changing government support of reprocessing (e.g. Carter vs. Reagan administrations) makes investment in reprocessing facilities entirely too risky.

   --At the present time, disposal of spent fuel is cheaper than disposal of all the wastes from reprocessing. All this says is that one would not reprocess only for the purpose of simplifying waste management. One would reprocess for the purpose of conserving the nation's energy resources.

Long-Term Storage

1. I have no reason to dispute the DOE figures.

2. The corresponding values of radioactivity in one metric ton of SF as a function of time after discharge from the reactor are:

Decay time (years)	Radioactivity (Ci/MTU)
10	3.9×10^5
20	2.8×10^5
30	2.1×10^5
40	1.5×10^5
50	1.0×10^5
100	4.1×10^4

The radioactivity of 25-year-old SF is estimated to be 2.4×10^5 Ci.

The ratios of radioactivity in 50-year-old SF are

$$\frac{10\text{ yr.}}{50\text{ yr.}} = 3.9$$

$$\frac{25\text{ yr.}}{50\text{ yr.}} = 2.4$$

--The lower radioactivity is an advantage, but hardly one that cannot be overcome by design of the package and the repository. Repository design for 50 yr. SF is simpler than for 10 yr. SF.

--I don't know of any reliable estimates of the cost differential of repositories for 50-yr.-old vs. 10-yr.-old SF and/or HLW. I'm sure DOE could come up with one.

3. Heat load from 50-yr.-old SF vs. that from 10-yr.-old SF.

--I doubt if an exact proportionality would pertain in space requirements because, as explained in part 2, Reprocessing space requirements are a function of a number of factors other than heat evolution rate at the time of emplacement. There would certainly be a major saving in space required for 50-yr.-old SF, however.

AMW:an
08/07/87

FOLLOWUP QUESTIONS FOR CHARLES HOLLISTER

Hearing on Nuclear Waste Legislation
July 17, 1987

1. International Law

Please describe the legal situation in terms of international law and treaties that the U.S. has signed relating to:

-- the dumping of radioactive waste into the oceans; and

-- subseabed disposal of high-level radioactive waste or spent fuel.

What legal obstacles, if any, have to be overcome before the U.S. could unilaterally dispose of spent fuel in a subseabed site in either the Atlantic or the Pacific?

2. Location

Where are the primary subseabed sites in the Pacific? (Yesterday we were told the sites were "off Hawaii")

Could you provide a map showing these sites?

Do the Japanese support subseabed disposal in the Pacific?

How about the governments of our former territories in the Pacific?

The Soviet Union?

Other governments with Pacific coastline?

Where are the primary sites in the Atlantic?

Do all the governments with Atlantic coastline support subseabed disposal in the Atlantic?

3. How it Works

Describe how subseabed disposal actually would work at these sites.

How much fuel would be contained in each cannister?

What kind of ship would bring the fuel out to the site?

What happens if there's an accident with the ship?

Do we have to have an MRS at the port where the fuel is loaded onto the ship?

Where would this be?

How much fuel could be stored at each site?

What is the assurance that radioactive material won't reach the ocean before it has decayed to acceptable levels?

What happens if there is a foulup at depth in the ocean? Can you recover the canisters?

4. How much it costs

How much did the research you were doing cost in the last fiscal year of funding?

How much would you have liked to have for that year?

You were on the verge of a more ambitious program on the ocean floor when funding was terminated, right?

What would that have involved and how much would it have cost?

What is the projected cost of demonstrating subseabed disposal?

What are your estimates of the cost of subseabed disposal if adopted as the means of disposing of U. S. spent fuel?

QUESTIONS FROM THE MINORITY - 7/17/87 HLW HEARING

Charles Hollister (Subseabed Disposal)

1. What international laws would have to be amended to allow the disposal of nuclear waste underneath international waters?
2. Would subseabed disposal allow for retrievability of the waste for 50 years, in case problems are discovered?
3. What environmental requirements would have to be met to permit subseabed disposal of nuclear waste?
4. What assurances do you have that *other* countries will rejoin the subseabed research effort if the U.S. recommitted to this program? Why is our participation in this program so crucial to foreign interest?
5. What kind of nuclear safety licensing process would be established for subseabed disposal?

RESPONSES TO FOLLOW-UP QUESTIONS
REGARDING TESTIMONY OF DR. CHARLES D. HOLLISTER
BEFORE THE SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
17 JULY 1987

QUESTIONS FROM THE MAJORITY

1. International Law

Three international legal agreements as well as general principles of international law are relevant to subseabed disposal of high-level radioactive waste. The agreements are the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention or LDC); the United Nations Convention on the Law of the Sea (UNCLOS); and the Treaty on the Non-Proliferation of Nuclear Weapons. Traditional freedom on the high seas and emerging principles of international environmental law also are applicable.

In considering the relevance of these agreements to subseabed disposal, it is important to distinguish between research and development activities (R&D) and implementation of subseabed disposal. R&D activities, which include site characterization and engineering design, are permitted under general principles of international law and all legal agreements. Implementation, which includes demonstration and full-scale operation, may require modification of the London Dumping Convention.

It also is important to distinguish between ocean dumping and subseabed disposal of radioactive waste. Ocean dumping is disposal of waste in ocean waters, where dilution, dispersion, and assimilation of waste are expected to prevent harm to human health and the marine environment. Ocean dumping of low-level radioactive waste is permitted under the London Convention, though there is nonbinding moratorium in place pending resolution of scientific and political issues. Ocean dumping of high-level radioactive waste is not permitted under the London Convention.

Subseabed disposal is the burial of waste in the ocean bottom, where the geologic medium is expected to retain the waste until it decays to negligible levels. The LDC does not explicitly address subseabed disposal because the subseabed disposal concept had not been developed when the agreement was drafted. Signatories to the LDC differ over the question of whether the agreement in its current form applies to subseabed disposal or whether the agreement would require modification to encompass subseabed disposal. The signatories have agreed, however, that R&D activities are permitted, that nations should not proceed with implementation until scientific and technical research has been completed, and that the LDC is the appropriate framework for international regulation of subseabed disposal. Under a plausible international regulatory framework, similar to that for dumping of low-level waste, the International Atomic Energy Agency (IAEA) would set standards, the Nuclear Energy Agency (NEA) would grant permits and monitor compliance, and nations would manage their own activities.

The United States has not ratified UNCLOS. UNCLOS reaffirms the freedom of marine research for peaceful purposes and, thus, sanctions subseabed R&D activities. UNCLOS seeks to control and minimize all sources of marine pollution but does not preempt the LDC. UNCLOS also seeks to control use of the seabed beyond the limits of national jurisdiction, and implementation of subseabed disposal may raise a jurisdictional question despite the preeminence of LDC.

The Non-Proliferation Treaty encourages international cooperation toward the peaceful use of atomic energy. International cooperation on subseabed disposal R&D is consistent with the Treaty's goal. Development of a subseabed repository under appropriate international management would contribute to non-proliferation objectives by providing the means for verifiably closing the nuclear fuel cycle.

Unilateral implementation of subseabed disposal by the United States in international areas would conflict with its commitment to LDC. Unilateral implementation within U.S. jurisdiction would not be prohibited by international law. In either case, the U.S. would be obliged under emerging principles of international environmental law to take measures to protect the marine environment.

In any case, U.S. implementation of subseabed disposal of high-level radioactive waste or spent fuel would require amendment to the Marine Protection, Research, and Sanctuaries Act (MPRSA). The MPRSA prohibits the issuance of permits for ocean dumping of high-level radioactive waste. Though one could argue over whether subseabed disposal constitutes ocean dumping as defined in the Act, the political reality is that the Act would have to be amended to allow subseabed disposal and establish a regulatory framework. A plausible regulatory framework would mandate the Environmental Protection Agency (EPA) to set standards and grant permits, the National Oceanic and Atmospheric Administration (NOAA) to monitor compliance, and the Nuclear Regulatory Commission (NRC) to license shoreside facilities.

It is useful to view the legal and political standing of subseabed disposal vis-a-vis that of land disposal, not because subseabed is a substitute for land disposal but rather as an indication of the political feasibility of both options.

Site Characterization
- Characterization of subseabed sites is legal and politically acceptable.
- Characterization of land sites is legal but, apparently, politically unacceptable to the host states.

Construction and Operation
- Implementation of subseabed disposal would require changes in the international LDC and U.S. MPRSA. These changes are neither likely nor appropriate until site characterization has been completed and the environmental effects of subseabed disposal have been determined to a high degree of confidence and have been found to be politically acceptable. Operation of a subseabed repository also would require approval by appropriate regulatory agencies, which may include the International Atomic Energy Agency, the Nuclear Energy Agency, and the U.S. EPA, NOAA, and NRC.

-- Construction of a land repository construction would not require changes in U.S. law, but it is uncertain whether it will be politically possible to induce a state to accept a repository. Operation of a land repository will require licensing by the Nuclear Regulatory Agency (NRC), which will depend on the results of site characterization and other R&D activities. It is possible that a site will be characterized and found unacceptable by the NRC. It also is possible that a fully-constructed repository will not be licensable for technical reasons, such as quality assurance failures and other technical uncertainties of the kind that have interfered with NRC licensing of other nuclear facilities. Though the NWPA provides a process for resolving these legal uncertainties, much will depend on the results of site characterization and the credibility of those results.

Both subseabed and land disposal, thus, face formidable legal and political obstacles. Successful implementation of either option depends on the quality and credibility of site characterization. Until that R&D has been completed, it is impossible to predict whether either option is viable.[1]

2. Location

Site investigations to date indicate that there are potential sites in the North Atlantic and North Pacific Oceans, but detailed site characterization is necessary before the suitability of those sites can be determined.[2]

Pacific

Potential sites in the North Pacific are hundreds of miles from any continent or island, including Hawaii (though, in oceanographic terms in which distances are measured in thousands of kilometers, the North Pacific sites could be said to be "off Hawaii," just as the moon is "near the Earth" in astronomical terms). Potential sites are located in the following areas:

Location B_1			
34°00'N	151°30'E	34°00'N	152°30'E
33°00'N	152°30'E	33°00'N	151°30'E
Location E_2			
32°40'N	163°25'E	32°40'N	165°00'E
32°05'N	165°25'E	32°05'N	165°00'E

Japan has an active subseabed R&D program and has been a participant in the Seabed Working Group, which operates under the auspices of the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, since 1977. Japan can be expected to continue subseabed R&D at some level, and there is reason to believe that Japan would increase its R&D activities if the U.S. recommenced its R&D program.

The governments of former U.S. territories in the Pacific do not appear enthusiastic about subseabed disposal, though potential subseabed sites are thousands of miles from these islands. Pacific island nations that currently do not have nuclear power obviously do not need radioactive waste disposal capability.

The Soviet Union is not involved in subseabed R&D, but has supported the right of nations to continue subseabed R&D.

Atlantic
Potential sites in the North Atlantic also are hundreds of miles from any continent or island and are located in the following areas:

Great Meteor East

32°00'N	26°00'W	30°00'N	22°00'W
33°00'N	25°00'W	33°00'N	23°00'W

Southern Nares Abyssal Plain

23°30'N	65°30'W	23°00'N	62°30'W
22°30'W	65°30'N	22°30'N	62°30'W

Several nations with Atlantic coastline are involved in subseabed R&D and are members of the Seabed Working Group. These nations are Canada, France, and the United Kingdom. Spain does not appear to favor subseabed disposal at this time. The positions of other Atlantic nations are not known.

3. How it works

Detailed engineering design of a subseabed disposal system has not been developed. Preliminary design of a waste package, shipping cask, disposal ship, and other components are available, and some conceptual schemes have been formulated.

It is reasonable to assume that subseabed disposal would be implemented as an international option under an appropriate international regulatory framework developed under the London Convention or another multilateral agreement. The U.S. probably would not be the only nation using a subseabed repository, and some degree of international standardization of subseabed disposal system components would probably occur.

In the U.S., packaging of high-level waste or spent fuel would be performed at a packaging facility, possibly located at a monitored retrievable storage facility (MRS) or at another inland location. The packaging facility probably would not be located at the port because ports are densely populated areas. The waste would be converted to a waste form, probably a glass of some sort. The waste form would be placed in canisters. The canisters would be placed in penetrators. The penetrators would be placed in transportation casks.

The amount of waste or spent fuel in each canister and the number of canisters in each penetrator would be depend on the waste form characteristics, heat and radionuclide loading requirements, canister and penetrator sizes. In any case, capacity is not a limiting factor in subseabed disposal. Several hundred-thousand metric tons (MTU) could be disposed in both the Atlantic and Pacific Ocean basins.

The transportation casks would be transported by rail, truck, or barge to a port, where they would loaded on the disposal ship. The canisters would not be removed from the shielded transportation casks at the port, but rather would be loaded directly onto the ship where the cask would provide protection to the crew. The port facility would require reliable capacity for loading the casks onto the ship and emergency response capability in the event of an accident in loading or while the ship was in port. Many ports on the Atlantic, Gulf, and Pacific coast would be suitable, though it would be prudent to use ports that have the best safety record for cargo handling and port access.

The ship would transport the casks to the disposal site. At the site, a cask would be opened and a penetrators removed and released through a "moonpool" (an opening in the hull). The penetrator would descend through the water column and embed itself tens of meters in the ocean bottom by the force of its own momentum. An instrument package on the penetrator would transmit to the ship the precise location and status of the penetrator. Penetrators would be emplaced 100 meters apart to ensure thermal isolation and prevent one penetrator from striking another. A monitoring system would be deployed to monitor the disposal site.

These operations can be accomplished using currently available technology. Penetrators have been tested and proved effective. Penetrator instrumentation and the monitoring system can be developed using state-of-the-art technology.

After the penetrator has been emplaced, the sediment provides the primary isolation barrier. Over the course of several hundred to several thousand years, radionuclides would leach out of the waste form and migrate through the canister and penetrator into the sediment. During this period, the relatively short-lived radionuclides would decay to negligible levels. Most radionuclides that reach the sediment will chemically bind to the sediment. Only the long-lived radionuclides that do not chemically bond to the sediment will be released into the ocean.

These long-lived, non-binding radionuclides will escape from any repository, regardless of whether it is in salt, basalt, granite, tuff, or seabed sediment. The issue is how much is released, over what period of time, with what effects on human health and the environment. The amount released from the sediment would be below current EPA limits for releases from a land repository into drinking water. By the time radionuclides released from the sediment reached the human environment, they would have decayed significantly. As a result, the estimated dose to the maximally exposed individual would not occur until 100,000 years after disposal and would be equivalent to one ten-millionth (1/10,000,000) of the natural background radiation that one gets just by living. (The maximally exposed individual is someone who lives on the beach and eats seaweed, shellfish, and shrimp every day.)

These calculations are based on laboratory studies of the sediment and mathematical models of how radionuclides released in the deep ocean could be transported to the human environment. In the laboratory studies, actual sediment samples were exposed to radionuclides, and the rate of migration and chemical binding were measured. The mathematical models are based on empirical measures of sediment properties, ocean currents, eddies, and other water movement. There is, however, some uncertainty involved in these calculations, as there is in any risk assessment, but it is important to note that there are real data for every step in the calculations. Such is not the case for the risk assessment models for land repositories.

Several accident scenarios have been analyzed. If an accident occurred during land transport or loading at the port, the transportation cask would provide protection against release of radiation. The transportation casks would be quite durable. If the ship ran aground or collided with another vessel but did not sink, the casks could be recovered from the ship through routine salvage operations. If the ship sank, which is unlikely in light of the current ship design, the casks could be salvaged, though the operation would be more difficult in deep than in shallow water. If casks were dropped from the ship, they could be recovered from the bottom using currently available technology, regardless of depth. If a penetrator were emplaced improperly, it could be recovered by overcoring the entire penetrator and surrounding sediment using a modified version of coring devices now in use. Retrieval of properly emplaced penetrators would be possible as long as the penetrators are in tact, which would be at least 100 years.

4. Cost

The estimated cost of developing and operating a subseabed repository for 250,000 metric tons (MTU) of high-level waste or spent fuel is $1.5 billion, as follows:

Site characterization: $250 million

Detailed characterization of three sites -- one in the Atlantic, one in the Pacific, and one within U.S. jurisdicton. This includes field experiments similar to the In Situ Heat Transfer Experiment (ISHTE) that was planned for FY-86 but was cancelled due to termination of the project. ISHTE was an instrumented platform that would be lowered to the ocean floor to perform tests in the sediment and water column to provide field confirmation of models developed on the basis of laboratory experiments. The ISHTE platform would be revised and deployed at each of the three sites to be characterized.

Engineering design: $360 million

Detailed engineering design of a subseabed disposal system, including waste package, packaging facility, land transport system, port facility, disposal ship, monitoring system, recovery system, retrieval system, and management system. Also includes NEPA process for selection of disposal site(s), port(s), and packaging facility.

Construction and demonstration: 580 million
Construction and pilot-scale operation of packaging facility; land transport system; port facility; disposal ship; monitoring, recovery, retrieval, and management systems.

Operation: $300 million
Full-scale operation for disposal of 250,000 metric tons (MTU).

Considerable cost-savings could be achieved through international cooperation, but it will require an immediate and strong commitment from the U.S. to persuade other nations to recommence their research programs. The U.S. has reneged on its commitments to subseabed research every year since 1984, and other nations do not believe that the U.S. is a reliable partner in cooperative international R&D.

In 1983, DOE presented a five-year budget for subseabed research in a report to OMB, and that report and budget became the basis for U.S. negotiations with other nations involved in subseabed research. The U.S. subseabed research team used this commitment to persuade other Seabed Working Group (SWG) nations to make similarly firm commitments so that the U.S. would account for less than half the total effort. Based on these budgetary commitments by the U.S. and other nations, the SWG developed a five-year research plan. In 1984, however, the U.S. reneged on its commitment, reducing its budget from the promised $7.5 million to $5.5 million, a 27% reduction. In 1985, the U.S. reneged again, reducing its commitment from $12.4 million to $7.5 million, a 40% reduction. In 1986, the U.S. commitment was $12.45, but DOE terminated the project.

In response to the U.S. termination, other SWG nations realized that they could not make up the difference and decided to phase out their projects as well. The SWG began to prepare a Status Report, which will be completed this year, and, then, the SWG will disband. Several nations, such as France and Japan, probably will continue their work at some level, but the cooperative international framework will no longer exist.

This experience has left other nations understandably skeptical of the U.S. commitment to subseabed R&D. These nations are not likely to make firm commitments again unless they have strong reassurance that, this time, the U.S. will stand by its commitment. If, however, the U.S. does make a firm commitment this year, the SWG can be salvaged and other nations can be persuaded over time to recommence their efforts as well. This approach would require immediate action and a strong policy commitment by the U.S., but it could reduce the U.S. cost by 30-50%.

Notes

1. Please see the following for more information:

"Considering an International Subseabed Waste Repository: Rational Choice and Community Interest," by John Norton Moore, The Washington Quarterly, Summer 1986.

"Subseabed Disposal of High-Level Radioactive Waste," by G.E. Hund, U.S. Congress, Office of Technology Assessment.

The Institutional Status of the Subseabed Disposal Project, November 1985, by Sharla G. Bertram et al, Sandia National Laboratories, Albuquerque, New Mexico, SAND 85-2082, May 1986.

Nuclear Waste Disposal Under the Seabed: Assessing the Policy Issues, by Edward L. Miles, Kai N. Lee, and Elaine M. Carlin, University of California, Berkeley, California, 1985.

Seabed Disposal of High-Level Radioactive Waste: A Status Report on the NEA Coordinated Research Programme, Nuclear Energy Agency, Organisation for Economic Co-operation and Development, Paris, France, 1984.

2. Please see the following for more information:

The Subseabed Disposal Program: 1983 Status Report, Sandia National Laboratories, Albuquerque, New Mexico, SAND83-1387.

RESPONSES TO FOLLOW-UP QUESTIONS
REGARDING TESTIMONY OF DR. CHARLES D. HOLLISTER
BEFORE THE SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
17 JULY 1987

QUESTIONS FROM THE MINORITY

1. Three international legal agreements as well as general principles of international law are relevant to subseabed disposal of high-level radioactive waste. The agreements are the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention or LDC); the United Nations Convention on the Law of the Sea (UNCLOS); and the Treaty on the Non-Proliferation of Nuclear Weapons. Traditional freedom on the high seas and emerging principles of international environmental law also are applicable.

In considering the relevance of these agreements to subseabed disposal, it is important to distinguish between research and development activities (R&D) and implementation of subseabed disposal. R&D activities, which include site characterization, engineering design, and testing, are permitted under general principles of international law and all legal agreements. Implementation, which includes demonstration and full-scale operation, may require modification of the London Dumping Convention.

It also is important to distinguish between ocean dumping and subseabed disposal of radioactive waste. Ocean dumping is disposal of waste in ocean waters, where dilution, dispersion, and assimilation of waste are expected to prevent harm to human health and the marine environment. Ocean dumping of low-level radioactive waste is permitted under the London Convention, though there is nonbinding moratorium pending resolution of scientific and political issues. Ocean dumping of high-level radioactive waste is not permitted under the London Convention.

Subseabed disposal is the burial of waste in the ocean bottom, where the geologic medium is expected to retain the waste until it decays to negligible levels. The LDC does not explicitly address subseabed disposal because the subseabed disposal concept had not been developed when the agreement was drafted. Signatories to the LDC differ over the question of whether the agreement in its current form applies to subseabed disposal or whether the agreement would require modification to encompass subseabed disposal. The signatories have agreed, however, that R&D activities are permitted, that nations should not proceed with implementation until scientific and technical research has been completed, and that the LDC is the appropriate framework for international regulation of subseabed disposal. Under a plausible international regulatory framework, the International Atomic Energy Agency (IAEA) would set standards, the Nuclear Energy Agency (NEA) would grants permits and monitor compliance, and nations would regulate their own activities.[1]

2. It would be possible to retrieve waste emplaced in the subseabed for at least 50 years. As long as the waste package is in tact, it can be retrieved using an overcoring device similar to that in use today. The waste package could be designed to last at least 100 years.

3. There are no official environmental requirements for subseabed disposal at this time. However, in assessing the risk of subseabed disposal, researchers have adapted the EPA standards for land-based repositories and found that subseabed can meet those standards with a large safety factor. For example, the amount of radionuclides released from the sediment at the bottom of the ocean is far below the EPA allowed limits for releases from a land repository into drinking water. Researchers also have used the standards of the International Commission for Radiological Protection (ICRP) and found that subseabed disposal meets those standards as well.

4. No nation -- with the possible exception of the Soviet Union -- has developed an operational repository for its spent fuel or high-level radioactive waste. Other nations are encountering technical and political problems similar to those in the U.S. Other nuclear nations, therefore, have every reason to rejoin the subseabed research effort if the U.S. makes a firm commitment. U.S. participation is crucial because we lead the world in oceanographic science and technology, though our lead in this field, as in others, is diminishing. Resuming subseabed research will help the U.S. maintain its leadership in oceanography.

5. Assuming that subseabed were developed as an international option, there probably would be an international and a U.S. licensing process. A plausible international process would have the International Atomic Energy Agency (IAEA) set standards, the Nuclear Energy Agency (NEA) grant permits and monitor compliance, and each nation manage its own operations. A plausible U.S. process would have the EPA set standards and grant permits, NOAA monitor compliance, and NRC license shoreside facilities, the ship, and waste package.

Notes

1. See the following for more information regarding legal and institutional issues:

> "Considering an International Subseabed Waste Repository: Rational Choice and Community Interest," by John Norton Moore, The Washington Quarterly, Summer 1986.
>
> "Subseabed Disposal of High-Level Radioactive Waste," by G.E. Hund, U.S. Congress, Office of Technology Assessment.
>
> The Institutional Status of the Subseabed Disposal Project, November 1985, by Sharla G. Bertram et al, Sandia National Laboratories, Albuquerque, New Mexico, SAND 85-2082.
>
> Nuclear Waste Disposal Under the Seabed: Assessing the Policy Issues, by Edward L. Miles, Kai N. Lee, and Elaine M. Carlin, University of California, Berkeley, California, 1985.
>
> Seabed Disposal of High-Level Radioactive Waste: A Status Report on the NEA Coordinated Research Programme, Nuclear Energy Agency, Organisation for Economic Co-operation and Development, Paris, France, 1984.

APPENDIX II

Additional Material Submitted for the Record

STATE OF TEXAS
OFFICE OF THE GOVERNOR
AUSTIN, TEXAS 78711

WILLIAM P. CLEMENTS, JR.
GOVERNOR

July 23, 1987

The Honorable J. Bennett Johnston
Chairman, United States Senate Committee
on Energy and Natural Resources
SD-364 Dirksen Senate Office Bldg.
Washington, D.C. 20510-6150

Dear Senator Johnston:

Governor Clements has received your letter of July 7, 1987 and has asked that I respond on his behalf for the record of the Committee's July 16, 1987 hearing on the high-level nuclear waste issue.

We have reviewed the bills considered in the hearing, and which you kindly forwarded with your request for comment. Those bills are as follows: Senator Hatfield's bill, S. 1007; Senator Hecht's bills, S. 1141, S. 1211, and S. 1428; and Senator Evans' bill, S. 1266.

The general concepts included in the package of bills represent incremental and unconnected approaches to amendment of the Nuclear Waste Policy Act of 1982 (Public Law 97-425), and in one case (S. 1007), amendment of the Hazardous Materials Transportation Act (Public Law 93-633), as well as the NWPA. The bills address such topics as regional monitored retrievable storage facilities, incentives to host states to accept a repository, further study and consideration of sub-sea bed and other alternative disposal technologies, long-term storage of wastes prior to disposal in a deep geologic system, spent fuel reprocessing studies, additional state involvement in nuclear waste transportation activities and associated emergency management programs, and participation of states adjacent to surface and underground water resources affected by potential repository sites.

It has been, and remains the position of the State of Texas, as presented in Governor Clements' earlier testimony to this Committee and the Nuclear Regulation Subcommittee of the Senate Committee on Environment and Public Works, that the Congress should cause to be undertaken a comprehensive review of the Nuclear Waste Policy Act of 1982 and its implementation since adoption of that legislation. This position has also been forwarded to the members of the Texas Congressional delegation by Governor Clements in a letter dated April 2, 1987 (see attached). It is our view that a Congressionally mandated, comprehensive review of high-level nuclear waste management and disposal policy and its implementation is the most effective and efficient means of determining the need for, and approaches to revision and amendment of the Nuclear Waste Policy Act of 1982.

While there may be many constructive and beneficial concepts and provisions in the bills you have requested we review, it is most appropriate that these and other policy alternatives be considered in the context of the comprehensive review described above. For this reason, and consistent with the announced position of the State of Texas, we recommend that the proposals contained within the subject bills be deferred for later consideration by a review commission such as that proposed in S. 748, introduced by Senator Sasser and others including Senator Bentsen. We support the approach taken in S. 748, and look forward to the opportunity to present our views in the appropriate context to the United States Senate.

We appreciate this opportunity to provide comments for the record of the Committee's July 16, 1987 hearing, and look forward to your continued interest in the matter of resolving the national need for safe and acceptable management and disposal of high-level nuclear wastes.

Sincerely,

Steve Frishman, Director
Nuclear Waste Programs Office

SF:dp
attachment

STATE OF TEXAS
OFFICE OF THE GOVERNOR
AUSTIN, TEXAS 78711

WILLIAM P. CLEMENTS, JR.
GOVERNOR

April 2, 1987

The Honorable Lloyd Bentsen
United States Senator
SH-703 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Bentsen:

I am writing to let you know of my concern over the progress and implementation of the Nuclear Waste Policy Act of 1982 and to inform you of the approach Texas is advocating regarding this matter. I would appreciate your consideration and support in this effort to resolve the very difficult problem at hand.

As you are aware, on May 28, 1986 President Reagan accepted the recommendation of the Secretary of Energy, John Herrington, that sites in Deaf Smith County, Texas, Yucca Mountain, Nevada, and on the Hanford Reservation, Washington, be named Candidate Sites for a deep geologic high-level nuclear waste repository. At the same time, contrary to the requirements of the Act, Secretary Herrington announced the indefinite postponement of site specific work leading to the naming of three candidate sites for a second repository.

During my previous term as Governor of Texas, I strongly advocated Texas' participation in the drafting of the Nuclear Waste Policy Act, and was gratified with the Congress' recognition that technical excellence and credibility is an essential factor in fostering beneficial public acceptance as we, together in the nation, seek a responsible and safe means of isolating these wastes from the accessible environment for the necessary thousands of years. Now, I feel I must report to you my disappointment in the conduct of this program as public confidence continues to be eroded through a site selection process that seems more centered on political expedience than technical excellence. In addition, the repository program is so burdened with controversy and litigation that, in my judgement, valuable time and money are being wasted while the failures of the site selection program become increasingly evident to observers and the affected public.

Last year the Congress expressed its concern with the implementation of the program by significantly cutting funding for FY 87 site specific program activities, including the start of exploratory shafts at the three candidate sites. The matter of program funding for FY 88 is now before the Congress, with a DOE budget request that is not only out of step with the President's budget proposal to Congress, but also does not conform to the requirements of the Nuclear Waste Policy Act. At the same time, the DOE's current budget request does not reflect a major management change that is proposed to be implemented during FY 88, in the form of a headquarters-level program integration contractor, known as a Systems Engineering and Development Contractor (SE&D). This shift to more central management control could have obvious benefits if it is properly implemented prior to detailed site characterization efforts at the three candidate sites. However, the DOE plans to implement the SE&D contractor approach on a phase-in basis while proceeding at a rapid pace into site characterization activities during the next two years. This introduction of the SE&D contractor into an established and ongoing planning and testing program is contrary to prudent engineering and research management procedure, and will result in a reduced ability to gain significant benefits from such an integrated management approach.

Given the continuing severe crisis in confidence in the repository site selection process that has resulted from the current three candidate site designations and deferral of the search for a second repository site, I recommend the following for your consideration during the current appropriations cycle: The entire Nuclear Waste Policy Act program should be reviewed by a congressionally appointed body over the next two years, and then appropriate action taken by the Congress to get the nation on a technically sound and reasonable track toward meeting our needs for safe and acceptable high-level nuclear waste management and disposal. To accomplish this objective, I suggest a congressional appropriation strategy that prohibits the DOE from advancing or carrying out any site specific characterization activities, including land acquisition. Meanwhile, during the two year period, a congressionally appointed commission, with sufficient technical staff support, should review the issue of high-level nuclear waste management and disposal and prepare a detailed report of recommendations to the Congress for its consideration. During the interim, the DOE program research and development activities, planning for deep geologic disposal, and implementation of an improved management structure should be continued in order to enhance the technical quality of the products and minimize delay when the Congress determines the appropriate directions for re-starting a waste management and site selection program.

I believe this proposed strategy to be an efficient and conservative approach that is well justified prior to risking the commitment of a number of years of site characterization work and the accompanying expenditure of nearly $1 billion per candidate site for site specific studies. Should such an approach be adopted, incorporating an effective moratorium on site-specific activities, plans, and investigations, I am prepared to pledge the cooperation of my office, and the considerable expertise of the Texas Nuclear Waste Programs Office in assisting the deliberations of a review commission.

I am greatly concerned about the viability of the nuclear waste repository program, and I hope my recommendations in this letter are viewed in the intended constructive light. If you have comments on this approach, or wish to have further discussion on the matter, please do not hesitate to contact me or my Nuclear Waste Programs Office.

Sincerely,

W. P. Clements Jr.

William P. Clements, Jr.
Governor of Texas

WPC/safp
enclosure

cc: Members, Texas Congressional Delegation

OFFICE OF THE GOVERNOR

FOR IMMEDIATE RELEASE
FEBRUARY 12, 1987

CONTACT: REGGIE BASHUR
O - 512/463-1826
H - 512/499-8387

COVERNOR EXPRESSES CONCERN ABOUT NUCLEAR WASTE SITE IN PANHANDLE, ANNOUNCES PUBLIC HEARING SCHEDULE

AUSTIN -- Governor Bill Clements announced today that he will send representatives to the Texas Panhandle later this month to attend U.S. Department of Energy public meetings on the federal government's search for the nation's first high-level nuclear waste repository.

The DOE meetings, Clements said, will be held in Hereford, Amarillo and Vega on February 24, 25 and 26. At the meetings, federal representatives will describe the projected activities, studies and land access plans associated with the review of the possible siting of the repository in the Texas Panhandle.

A major item expected to be discussed at the meetings will be the DOE's plan to move 700 families into the region during 1987. The employees will perform a major "site characterization" approved last year by the President.

The DOE's plans to move workers into the Panhandle does not imply that the nuclear waste repository will be built near Vega, Clements stressed.

Clements, since his inauguration last month, has criticized the government's site selection process, complaining the DOE has failed throughout the process to adequately consider the potential impact of study activities on the agricultural economy and critical groundwater resources in and around the proposed Deaf Smith County site.

Clements gave a statement to the U.S. Senate Committee on Energy and Natural Resources in early February. The statement outlined some of his critical concerns regarding a variety of technical issues at the proposed Deaf Smith County site.

This site, along with sites in Nevada and Washington State, is currently being reviewed by the DOE as locations for the repository.

"The DOE," Clements said, "has failed to provide sound and credible substantiation for the selection of Texas, Nevada and Washington as candidate sites. That finding has been expressed in several lawsuits that Texas has brought against the DOE."

Clements also criticized the agency for not consulting with Texas, as an affected state, in a manner set out by Congress and the Nuclear Waste Policy Act.

"The department has failed to adequately consider the potential impact of the program activities on the agricultural economy and critical groundwater resources in and around the Deaf Smith County site," said Clements.

"Given the extent to which Deaf Smith County farmers, ranchers and residents rely on the Ogallala and Santa Rosa aquifers for their livelihood, we believe the Department of Energy should pay more attention to what is obviously a critical and limited natural resource."

The start-up date for the repository has been delayed until 2003. Despite that, Clements said the federal agency "continues to cloak the entire program with a veil of optimism."

Added Clements: "The greater likelihood is that additional uncertainties will emerge as investigations progress, which will only cast a longer shadow over the department's ability to select a site that can perform in the required manner."

Attending the Panhandle meetings on behalf of the governor will be Dillard Hammett, the governor's energy advisor, and Steve Frishman of the State High-Level Nuclear Waste Office.

--30--

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

STATE OF OREGON

JULY 16, 1987

Grant Application
for
Oregon State Activities
under
The Nuclear Waste Policy Act
of 1982

For Calendar Year
1987

Submitted to:

The United States Dept. of Energy
Richland Operations Office
by
The Oregon Dept. of Energy
In cooperation with:

The Oregon Hanford Review Committee

December 1986

INTRODUCTION

Oregon has significant and unique concerns over the Hanford site being nominated as a possible commercial high level nuclear waste repository. The Governor of Oregon has directed the Hanford Review Committee to study, review and comment on activities related to repository siting at Hanford.

Because the issues surrounding Hanford's nomination and characterization are highly technical, Oregon must apply technical staff resources to participate in site review. Grant/Contract funds requested in this application will be used to support staff efforts in technical review, public information and education, and interagency coordination.

The Oregon Department of Energy, as lead state agency for Hanford review, would serve as Oregon's Grant/Contract receipient. In turn, we will contract for those technical skills found in other state agencies. Oversight of Hanford review activities will be provided by the Oregon Hanford Review Committee. Assistance with public information and development of technical review comments will be provided by the Oregon Hanford Advisory Committee.

This application is being submitted to the U.S. Department of Energy, Richland Operations Office, Richland, Washington 99352 and the Washington Department of Ecology, Office of Nuclear Waste Management, Lacey, Washington. The period of grant/contract performance is January 1, 1987 through December 31, 1987. The principle contact is:

David A. Stewart-Smith, Manager
Radioactive Materials Program
Oregon Department of Energy
625 Marion Street, NE
Salem, Oregon 97310

(503) 378-3187

PROJECT DESCRIPTION

TITLE: Review and Comment

PURPOSE: To prepare, in cooperation with the Hanford Review Committee, Oregon's position on major federal documents related to Hanford Site Characterization.

JUSTIFICATION: Oregon has unique and significant concerns about Hanford's possible selection as a high level waste repository. In order to adequately represent the interests of Oregonians, a significant level of staff involvement is necessary. Communication with US DOE and contractor technical staff is imperative. Comments on major project documentation will be necessary to ensure Oregon's proper involvement.

% of Resources	
40%	Site Characterization Plan
5 %	Final EA/Responses to Comments
10%	Continued review of impacts of Defense Waste on BWIP
45%	Site Characterization Research Documents

HD Contract	Environmental Surveillance Review/Analysis
OWRD Contract	Hydrology Review
DOGAMI Contract	Structural Geology Review
OSU Contract	Nuclear/Structural Engineering Review

We plan to thoroughly review this documentation by coordinating the efforts of several state agencies. Interagency review will be our major effort.

Final review of major documents will be in the form of a report to the Governor. These reports will serve as the basis for developing recommendations to the US DOE for improvement, implementation or termination of Site Characterization projects. These reports will represent the State of Oregon's official response to the US DOE.

Travel cost estimates related to this project are based on our judgment that direct contact between professionals will enhance the quality of our review.

We intend to fully participate in quarterly meetings on milestone documents. In-state and regional travel expenses are also needed to coordinate Oregon's interagency review and coordination with the Washington Nuclear Waste Board, and affected Indian tribes.

Target Audience: US DOE, Oregon Agency staff, Governor and Legislature, interested citizens.

Budget Estimate: Review and Comment

Personal Services:

Division Administrator	3%	x 12 mo x	4375	=	1,575	
Program Manager	10%	x 12 mo x	3,450	=	4,140	
Program Coordinator	25%	x 12 mo x	2,607	=	7,821	
Geologist	45%	x 12 mo x	3,086	=	16,664	(2)
Hydrologist	45%	x 12 mo x	3,160	=	17,064	(1)
Health Physicist	10%	x 12 mo x	2,222	=	2,666	(3)
Public Information Specialist	5%	x 12 mo x	2,100	=	1,260	
Senior Analyst	10%	x 12 mo x	2,604	=	3,125	
Transportation Analyst	15%	x 12 mo x	3,125	=	5,625	
					59,940	
OPE (35% of P.S.)	-----------------				20,979	
		subtotal PS			80,919	

Travel:

1 trip every month to Richland for 2 people	
24 airfare @ $150	3,600
36 days per diem @ $60	2,160
Mileage/care rental/parking	1,080
2 overnight trips per month for 2 people, regional travel	
72 days per diem @ $55	3,960
mileage/car rental/parking	1,440
2 trips per year for 1 person to Washington, D.C.	
2 airfare @ $750	1,500
6 days per diem @ $85	510
Ground transportation/parking/miscellaneous	100
subtotal Travel	14,350

Other Contracts:

Attorney General's Office		2,000
Oregon State University Contract		15,000
	TOTAL DIRECT COSTS	112,269

Indirect Costs:

HD Indirect		500
WRD Indirect		4,000
DOGAMI Indirect		4,000
ODOE Indirect		15,893
	Total Indirect	24,393
	PROJECT TOTAL COST	136,662

As part of this project total, these contracts will be included:

(1) = Water Resources Department = $31,500
(2) = Department of Geology = $30,500
(3) = Health Division = $ 5,500

Performance under these contracts will be subject to a more detailed scope of work.

Project Title: Monitoring, Analysis and Studies

Purpose: To participate with affected governments and tribes in the observation and analysis of US DOE and contractors in all parts of repository development. To analyze and study the possible impacts of repository siting on the Pacific Northwest, concentrating on Oregon impacts.

Justification: To represent the unique and significant concerns of the people of Oregon and to work toward regional coordination of monitoring efforts.

Description: In order that Oregonians interests be adequately represented, we must be a part of the early site characterization work. We will prepare comments and propose research designs. We will also communicate our ideas and comments to the public, other state agencies, the Oregon Legislature and interested organizations. In addition, we will seek to address all reasonable issues brought to our attention through this process.

Governor Atiyeh has directed the Oregon Hanford Review Committee to coordinate agency efforts on Hanford Repository issues. Included in this direction is the analyses of all possible impacts on Oregon from a Hanford Repository.

An estimated level of effort should be:

% of Personnel Time		Activity
50%	-	Review of US DOE research, analysis and procedures
20%	-	Participation in the development of project workplans.
10%	-	Transportation impact studies.
10%	-	State emergency response capability analysis and studies.
10%	-	Socioeconomic impact analysis.

Law Clerk/Attorney General Time	State liability issues, water allocation/rights issues.
WRD Contract	Hydrology
OSHD Contract	Environmental monitoring
DOGAMI Contract	Structural Geology
OSU Contract	Nuclear/Structural Engineering

Oregon will have no dedicated Assistant Attorney General support. As with all other issues Oregon agencies have responsibility for, we request Attorney General support, and are billed for the time spent.

Travel costs associated with this project assume periodic meetings will be necessary between technical staff in Oregon and their counterparts in Washington and Richland. The need for such meetings will be driven by the research being reviewed.

In addition, independent studies and analysis of socio-economic impacts, emergency response, and transportation will require periodic meetings with the Umatilla Indian tribe, local governments and local first response agencies. Consultation with other states through such associations as the Western Interstate Energy Board, the National Governor's Association, and the Council of State Legislatures will also be part of our effort.

TARGET AUDIENCE: US DOE and contractors, Western States, Indian Tribes, Federal agencies, technical/academic community and the general public.

Budget Estimate: Monitoring, Analysis and Studies

Personnel Services:

Division Administrator	3% x 12 mo x 4,375	=	1,575
Program Manager	10% x 12 mo x 3,450	=	4,140
Program Coordinator	25% x 12 mo x 2,607	=	7,821
Geologist	45% x 12 mo x 3,086	=	16,664
Hydrologist	45% x 12 mo x 3,160	=	17,064
Health Physicist	20% x 12 mo x 2,222	=	5,332
Public Information Specialist	5% x 12 mo x 2,100	=	1,260
Senior Analyst	10% x 12 mo x 2,604	=	3,125
Transportation Analyst	15% x 12 mo x 3,125	=	5,625
	subtotal PS		62,606
OPE (35% of P.S.)	-----------------		21,912
	subtotal PS		84,518

Travel

2 trips per month for 2 people to Richland

48 airfare @ $150	7,200
48 days per diem @ $60	2,880
mileage/car rental	2,000

2 overnight trips per month for 2 people in-state	
24 airfare @ $200	4,800
48 days per diem @ $60	2,400
mileage/car rental	3,000
4 trips per year for 1 person out of state	
4 airfare @ $500	2,000
12 days per diem @ $75	900
mileage/car rental	300
subtotal Travel	25,480

Other Contracts:

OSU - Nuclear, Structural Engineering	20,000
Attorney General	2,000
TOTAL DIRECT	131,998

Indirect Costs:

OSHD - Environmental Surveillance/Analysis, Indirect	500
OWRD - Hydrology, Indirect	4,000
DOGAMI - Structural Geology, Indirect	4,000
ODOE - Indirect	15,893
Total Indirect	24,393
PROJECT TOTAL COST	156,391

As part of the project total, these contracts will be included:

(1) = Water Resources Department = $36,000
(2) = Department of Geology = $34,000
(3) = Health Division = $12,000

Performance under these contracts will be subject to a more detailed scope of work.

Project Title: Public Information

Purpose: To work to inform Oregon citizens of current Hanford issues. To seek public input on critical policy issues.

Justification: Oregonians are concerned about issues of nuclear waste disposal. As directed by the Governor, Oregon agencies are to coordinate our efforts on Hanford review. This includes a public information effort to inform Oregonians of what we are doing in their name.

Description: The Program Manager will supervise a public information program designed and implemented by the Public Information Specialist. The Oregon DOE's Hanford Advisory Committee will assist in the design of this effort.

The goal of this program will be to:

1. Provide factual and timely information to the public about the range of repository related issues.

2. Provide for periodic opportunities for the public to express opinions about projects and nuclear waste disposal issues.

Oregon's public information workplan will be revised to encompass new and expanded resources. We will regularly contribute to the Washington Nuclear Waste Board's newsletter on Oregon's involvement.

We will work to coordinate our efforts with those of the Confederated Tribes of the Umatilla Indians.

We will continue to offer to speak to groups on Hanford issues, moving towards establishing a "speakers bureau." We will look into the value of holding public workshops or informational hearings on major issues. We will respond to citizen inquiries, and provide information to all interested parties.

We will serve as a reference center for Hanford issues. By appointment, we will provide space and documentation for interested individuals to review and study US DOE documents and research reports.

Target Audience: All Interested Persons

Budget Estimate: Public Information

Personnel Services:

Division Administrator	4% x 12 mo x 4,375	=	2,100
Program Coordinator	25% x 12 mo x 2,607	=	7,821
Program Manager	10% x 12 mo x 3,450	=	4,140
Geologist	10% x 12 mo x 3,086	=	3,703
Public Information Specialist	30% x 12 mo x 2,100	=	7,560
Public Information Manager	15% x 12 mo x 3,914	=	7,045
Hydrologist	10% x 12 mo x 3,160	=	3,792
Administrative Assistant	10% x 12 mo x 1,278	=	1,534
Health Physicist	3% x 12 mo x 2,222	=	800
Senior Analyst	10% x 12 mo x 2,604	=	3,125
Transportation Analyst	10% x 12 mo x 3,125	=	3,750
	subtotal P.S.		45,370
OPE (35% of P.S.)	-----------------		15,880
	subtotal PS		61,250

Travel:

Advisory Committee Travel		
3 airfare/bimonthly @ $150		2,700
24 days per diem @ $50		1,200
mileage/car rental/parking		1,200
1 person per quarter trip to Richland		
4 airfare @$150		600
4 days per diem @ $60		240
mileage/car rental/parking		200
	Total Travel	6,140

Other Contracts:

Graphics Consultant		5,000
Public Involvement Consultant		4,500

Services and Supplies

Printing/Copying		13,096
Room Rental		1,800
	subtotal S&S/Other Contracts	24,396
	TOTAL DIRECT	91,786

Indirect Costs:

ODOE Indirect		25,026
DOGAMI Indirect		2,500
WRD Indirect		2,500
	TOTAL INDIRECT	30,026
	PROJECT TOTAL COST	121,812

As part of this project total, the following contracts are included:

(1) = Water Resources Department = $ 8,620
(2) = Department of Geology = $ 8,500
(3) = Health Division = $ 1,000

Performance under these contracts will be subject to a more detailed scope of work.

Project Title: Coordination & Administration

Purpose: To support the coordination of Oregon state agency review efforts, and to work toward regional cooperation between states and tribes.

Description: Coordination of review efforts between Oregon and Washington and the affected Indian tribes will serve to better address issues and reduce duplication of efforts. Such areas include:

a) regional hydrology/groundwater use and planning;

b) regional tectonics/geology;

c) Columbia River use; and

d) Environmental Surveillance related to the Basalt Waste Isolation Project.

In addition, ODOE is charged with leading Oregon's interagency review of Hanford and other high level waste issues. This entails making preliminary determinations of which agency should review documents, and placing the comments and analysis into one Oregon document.

Interstate: Oregon will continue to participate on the Washington environmental monitoring, transportation, historical document review and defense waste committees in order to coordinate joint activities. We also intend to begin work with the socio-economic committee of the Board.

We will continue to work closely with local governments and the Umatilla tribe on transportation and water quality issues related to Hanford. Several cities and counties in Oregon have taken independent action on Hanford issues. We will work to keep them informed, and part of a constructive, state-wide effort to review and comment on Hanford site characterization research.

State & Federal A significant effort will be necessary to coordinate Oregon activities with those of the USDOE-RL and headquarters. We will work to concentrate review efforts on particular issue within the most useful timeframes. Close communication will be necessary to keep the program flowing smoothly.

Target Audience: All levels of Pacific Northwest and Federal Government.

Budget Estimate:

Personnel Services:

Division Administrator	10% x 12 mo x 4,375	=	5,250
Program Manager	20% x 12 mo x 3,450	=	8,280
Program Coordinator	25% x 12 mo x 2,607	=	7,821
Administrative Assistant	40% x 12 mo x 1,278	=	6,134
Transportation Analyst	10% x 12 mo x 3,125	=	3,750
			31,235
OPE (35% of P.S.)			10,932
	subtotal P.S.		42,167
Attorney General @ $50/hr			4,000
Supplies			5,000

Travel:

9 members of Review Committee to attend six meetings.		
Mileage		800
2 different committee meetings per mo. in Olympia.		
Per diem @ $55		1,320
Mileage/parking		1,375
2 trips to Washington, D.C. per year		
2 airfare @ $750		1,500
6 days per diem @ $85		510
Mileage/ground transportation/parking		120
4 state and tribes meetings 2 persons per year		
8 airfare @ $250		2,000
24 days per diem @ $65		1,560
Miscellaneous		360
4 BWIP Quarterly meetings per year		
4 airfare @ $150		600
8 days per diem @ $60		480
Mileage/parking		280
6 trips to Richland, Coord.		
6 airfare @ $150		900
12 days per diem @ $60		720
Mileage/parking		360
	Total Travel	12,885
	Total Direct	64,052
	ODOE Indirect	21,083
	PROJECT TOTAL COST	85,135

As part of this project total, the following contracts are included:

(1) = Water Resources Department = $ 3,500
(2) = Department of Geology = $ 3,500
(3) = Health Division = $ 750

Performance under these contracts will be subject to a more detailed scope of work.

DS-S/MLB:jf
1112L(d2,f6)
12/08/86

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Department of Energy

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The OREGON HANFORD REVIEW COMMITTEE was formed in 1985 to insure that the health, safety, and environment of Oregonians are addressed and protected:

1. during studies of a potential repository for high level radioactive wastes at Hanford Washington,
2. if a repository for high-level radioactive waste is established at Hanford
3. when shipments of high-level radioactive waste occur though Oregon enroute to future storage or disposal facilities, and
4. when special shipments to and disposal of non-radioactive material at Hanford occur

This committee is made up of nine state agencies to include the Oregon Department of Energy, Department of Geology and Mineral Industries, Emergency Management Division, Public Utility Commissioner's Office, Water Resources Department, Oregon State Police, Oregon State Health Division, Department of Environmental Quality and Oregon State University-Graduate School.

Four members comprise the Transport Subcommittee and four comprise the Water Subcommittee.

The OREGON HANFORD ADVISORY COMMITTEE was formed in 1985 to provide the people of Oregon access to all available information on Hanford, and to provide public input into Oregon's technical review process. The Hanford Advisory Committee advises the Hanford review Committee regarding public concerns with the issues. The Advisory Committee also assists in developing and implementing public information and involvement programs.

The Advisory Committee is comprised of 32 individuals equally representing Public Interest Groups, Elected Officials, State Boards and Commissions and Industry.

This group is evenly divided on Water and Transport Subcommittees.

Eight members elected from the Advisory Committee serve on the Steering Group which makes recommendations to the Advisory Committee, sets agendas, gives Status Reports, helps make decisions and recommends positions.

The Review Committee meets as necessary and the Advisory Committee and Steering Committee meet bi-monthly on alternating months.

Further information on Oregon's Hanford Committee activities can be obtained by contacting David Stewart-Smith, Manager, Radioactive Materials Program (378-3187), or Mary Lou Blazek, Hanford Program Coordinator (378-5544), for the Oregon Department of Energy.

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June, 1986

OREGON'S INVOLVEMENT IN THE STORAGE, TRANSPORT, AND DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTES

A Retrospective and Prospective Chronology

The U.S. Department of Energy (US DOE) is considering Hanford, Washington as one of three candidate sites for a permanent repository for high-level radioactive wastes. US DOE now stores high-level defense wastes at Hanford. This paper offers a brief review of Oregon's involvement with the transport, storage, and disposal of high-level radioactive wastes. There are many other nuclear issues in which Oregon is involved. For example:

- Since 1975, Oregon has been involved in reactor safety and emergency preparedness for the Trojan Nuclear Power Plant and Oregon's two research reactors.

- Since 1980, Oregon has been involved in safety issues related to shipments of low-level radioactive material -- about 1,500 shipments per year to Hanford. Special efforts have been given to large shipments, such as barge shipments on the Columbia River.

- At Governor Atiyeh's direction in 1980, Oregon helped shape Federal law to require regional solutions to low-level waste disposal. Oregon and other Northwest states were first to develop and implement these solutions.

- In 1981, Oregon began aggressive programs to clean up sites containing naturally-occurring radioactive materials.

- In 1981, Oregon began participating in emergency preparedness programs for the nuclear facilities at Hanford.

- In 1985, Oregon began a review of Trojan decommissioning. Our experience there provides valuable knowledge on decommissioning the old Hanford reactors.

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- In 1986, Governor Atiyeh initiated a review of the safety of the N-Reactor at Hanford.

Oregon already has addressed the generic issues of high-level radioactive wastes transport, storage and disposal. Oregon now is a state adjacent to a potential repository and defense waste storage site. Oregon also is a state through which much high-level nuclear wastes will be transported regardless of where a repository is built. Our goal is to ensure that Oregon's interests are represented and protected.

We are not convinced that Hanford is an appropriate site for a repository. Further, we must ensure that continued storage or disposal of the defense wastes will not harm Oregon. Even if Hanford is not chosen as the repository, we must address transport from Trojan and Hanford. Because the US DOE's site selection study for the first repository has narrowed the field to three sites, much more detailed information on the Hanford site will be developed over the next five years. We intend to participate fully.

Oregon is currently devoting the time of about four persons to these issues. That includes participating in several public meetings each month. We intend to increase our level of effort.

Issue Summary

America's first commercial nuclear power plants came on-line in the late 1950s. The U.S. government promised to dispose of high-level radioactive wastes from these plants. But all attempts to site a permanent disposal facility have failed. Federal agencies could provide neither good management nor design a publicly acceptable process and schedule to develop disposal facilities. Nuclear power plants, including Trojan, have been obliged to expand temporary, on-site storage for high-level radioactive wastes.

In 1982, Congress passed the Nuclear Waste Policy Act. The Act established the process and schedule for developing a deep geologic repository for high-level radioactive wastes by 1998. The Act also provides for review by the host state and affected Indian Tribes and veto by the host state. A veto by the host state can be overridden by Congress. It gave no rights to affected adjacent states.

The possibility of a permanent repository and the current defense wastes stored at Hanford are of grave concern to Oregonians. Hanford is adjacent to the Columbia River, which flows more than 300 miles between Oregon and Washington. As an adjacent state, Oregon would share many of the economic and environmental costs of the host state. These costs include increased transport of nuclear wastes through the state. And, there are risks and potential costs associated with a repository and defense wastes adjacent to the Columbia River and in a groundwater system that we share.

Retrospective Chronology

Oregon has addressed issues of the transport and disposal of radioactive material, including high-level radioactive wastes, since the early

1960s. Until Hanford was considered as one of three candidate sites for the first repository, Oregon had not addressed the issue of permanent disposal on a site-specific basis. We began those efforts in December 1984.

DATE	EVENT
Early 1960s	The Oregon Health Division began to monitor the Columbia River downstream from Hanford because of radioactive releases from the government reactors and defense wastes stored there.
Early 1970s	The State considered the safety of future transport and disposal of high-level radioactive wastes before the Trojan nuclear plant was sited and built.
1976	Trojan came on-line.
1975-1978	The status and future of transport and disposal of high-level radioactive wastes again was reviewed during a contested case to site the Pebble Springs nuclear plants.
1978-1979	Before allowing expansion of the storage capacity at Trojan, it was concluded, following extensive public hearings, that future safe transport and disposal of high-level radioactive wastes was achievable.
1979-1980	At the request of the 1979 Legislature, a review of high-level radioactive waste disposal was conducted. The study concluded that the technology for future safe disposal existed but that specific sites must thoroughly be studied.
1980-1981	Oregon began to develop written agreements on the transportation of radioactive material.
1981	At Governor Atiyeh's request, the Legislature established the authority to regulate the transportation of radioactive material in Oregon and to establish an emergency preparedness program for transportation accidents. The Radioactive Materials Advisory Committee, composed of representative local governments, state agencies, and industry was formed. It provides guidance for both development of regulatory programs and emergency response.
February 1982	Representative Ron Wyden requested Oregon comments on Nuclear Waste Policy Act proposal.
March 1982	Governor Atiyeh requested that the Act provide for review by adjacent states. (Letters to Representative Wyden, and Senators Hatfield and Packwood.)

May 1982	Governor Atiyeh provided additional comments on the Act and renewed his request that the Act provide for reviews by adjacent states. (Letter to Representative Wyden.)
July 1982	Governor Atiyeh re-emphasized the need for review by adjacent states. (Letter to Representative Wyden.)
	Oregon implemented a program to regulate the transport of radioactive materials in and through the state. With that completed, work began on an emergency preparedness program.
	Since 1982, the emergency preparedness program has trained more than 1,000 fire, law enforcement, and other emergency workers. Radiation detection kits have been distributed along primary routes. A general plan for handling an emergency has been developed.
December 1982	Oregon received the initial Hanford Site Characterization report from US DOE.
	Congress passed the Nuclear Waste Policy Act. The Act established the process and schedule for developing a permanent repository for high-level radioactive wastes. Governor Atiyeh supported the Act but continued to argue for rights of adjacent and affected states.
February 1983	US DOE Secretary Don Hodel informed Governor Atiyeh of federal plans for implementing the Nuclear Waste Policy Act.
April 1983	Concerned about early nomination of Hanford for detailed studies, Governor Atiyeh directed ODOE to lead a Hanford Review Committee of state agencies to address Oregon's interests. (Memo to State agencies.)
	US DOE notified Governor Atiyeh of its intent to prepare an Environmental Impact Statement regarding defense-related nuclear wastes at Hanford.
	Governor Atiyeh notified US DOE and NRC of Oregon's intent to participate in Hanford review. (Letters to Alex Fremling and John Davis.)
	Governor Atiyeh discussed a cooperative review effort with Governor Spellman of Washington. (Letter to Governor Spellman.)

May 1983	Oregon proposed and the Western Interstate Energy Board agreed to a policy resolution establishing a regional review of transporting high-level waste.
June 1983	Oregon representatives toured the repository and defense waste facilities at Hanford.
	Oregon requested US DOE review funding from the U.S. Senate Appropriations Committee. (Letter to Steve Crow.)
July 1983	Governor Atiyeh proposed and the National Governor's Association agreed to a policy resolution to the NRC to provide for affected adjacent state reviews.
	Governor Atiyeh requested review funding from US DOE and recommended a joint state review to Governor Spellman of Washington.
	US DOE refused the funding request, but agreed to reconsider Oregon's case when potential sites were narrowed from nine to three. Washington state said that a joint review was premature.
September 1983	Oregon again requested US DOE review funding from U.S. Senate Appropriations Committee. (Letter to Steve Crow.)
	Oregon representatives toured the repository and defense waste facilities at Hanford and the repository facilities at the Nevada Test Site.
October 1983	Oregon renewed requests for review funds from US DOE. (Letter to Alex Fremling.)
February 1984	US DOE denied Oregon's request for review funds.
May 1984	Governor Atiyeh received the draft mission plan for the repository from US DOE.
June 1984	Governor Atiyeh again requested US DOE review funds from Secretary Hodel. (Letter to Don Hodel.)
July 1984	ODOE hired a transportation coordinator to address Oregon's concerns on transportation of radioactive material.
	ODOE published procedures for high-level radioactive wastes shipments in Oregon to ensure effective regulation and emergency response.
July 1983 to December 1984	Additional storage capacity for high-level radioactive wastes at Trojan was reviewed and approved. It was concluded that the ability to safely transport and dispose high-level radioactive wastes could be

	developed. However, because of uncertainty of when a repository would be operational, Oregon launched a review of the plans and funding for continued temporary storage of Trojan high-level radioactive wastes beyond the useful plant lifetime. This issue was addressed in a broader review of Trojan decommissioning.
August 1984	US DOE denied Governor Atiyeh's request for review funds.
September 1984	Oregon began an intensive review with the Western Interstate Energy Board of the safe transport of high-level radioactive wastes to a repository. This effort involves meetings about every three months. Oregon and Nevada serve as co-chairs of that review.
December 1984	In a draft environmental assessment, Hanford was recommended as one of three sites to study as a potential repository.
	Governor Atiyeh endorsed ODOE proposals for increased efforts to resolve Oregon's concerns regarding a Hanford repository and storage of defense wastes.
January 1985	Oregon's Hanford Review Committee, consisting of nine state agencies, began technical reviews. The committee meets about every two to three months. (See attached membership and mission.)
	ODOE hired a Manager, Radioactive Materials Programs to devote half-time to high-level waste issues. Oregon's effort increased to about 1.5 persons.
	ODOE began working with the Legislature on concerns about high-level wastes.
	Governor Atiyeh proposed a joint Oregon/Washington review of the Hanford repository and storage of defense wastes to Governor Gardner. (Letter to Governor Gardner.)
	Governor Atiyeh and Governor Gardner of Washington agreed to initiate a joint review.
	Oregon initiated discussions with the Umatilla Indians, an affected tribe, to participate in a joint review. (Letter to Elwood Patawa.)
February 1985	Governor Atiyeh again requested funding from US DOE for an Oregon review. (Letter to Ben Rusche.)

	Oregon representatives spoke on high-level waste issues at a conference sponsored by the Columbia River Intertribal Fish Commission. Oregon offered to cooperate with the affected tribes.
March 1985	ODOE's Hanford Advisory Committee was formed to ensure public concerns are being addressed. The Committee meets about every two months. (See attached membership and mission.)
	At Oregon's request, US DOE held a public hearing in Portland on the proposed repository. ODOE and several legislators expressed concerns (testimony of Lynn Frank).
	Oregon sent numerous concerns about the proposed repository to US DOE (letter to Ben Rusche).
	Oregon began attending monthly meetings of Washington's Nuclear Waste Board and Advisory Council. Oregon liaisons have been established for Washington's committees on environmental monitoring, transportation, socio-ecomomics, and defense wastes.
April 1985	The Oregon Legislature passed Senate Joint Memorial 13 calling for the amendment of the Nuclear Waste Policy Act to include Oregon as an affected state. The Legislature also passed Senate Bill 622 calling for timely removal of spent nuclear fuel from Trojan. Governor Atiyeh signed Senate Bill 622.
	Oregon's Hanford Review Committee toured the repository and defense waste facilities at Hanford.
	Governor Atiyeh supported Governor Earl of Wisconsin in a request to NRC to broaden its perspective on transportation issues. (Letter to Governor Earl.)
May 1985	US DOE again refused to provide direct funding but agreed to support the joint review with Washington.
	Representative Weaver introduced an amendment to the Nuclear Waste Policy Act to include Oregon as an affected state.
	ODOE presented to the Washington Nuclear Waste Board a proposal for a joint Oregon/Washington review effort, and partial funding of Oregon's review by Washington.
June 1985	ODOE's Hanford Advisory Committee toured the repository and defense waste facilities at Hanford.
	Oregon established a cooperative effort with US DOE and Washington on high-level shipments from Hanford.

	Oregon representatives toured the old Hanford reactors and observed other decommissioning activities at Hanford.
July 1985	Oregon and Washington signed a contract for $20,000 to develop a joint review process by October 1985. Governor Atiyeh requested further support from Governor Gardner on implementing the joint review. (Letter to Governor Gardner.)
	ODOE took legislators on a tour of Hanford repository and defense waste activities.
	ODOE established a steering group for the Hanford Advisory Committee. The group provides overall direction. It meets every two months.
	Oregon began discussions with US DOE on written agreements for issues of mutual concern. Initial effort was devoted to emergency preparedness and response for radiation accidents in Oregon and at Hanford.
	ODOE spoke on emergency preparedness at a national conference on transportation of high-level waste sponsored by NRC.
August 1985	ODOE spoke on high-level waste issues at a conference on Hanford sponsored by Representative Wyden and Portland Commissioner Lindberg.
	ODOE worked with legislators to introduce a resolution on high-level waste issues to the Western Legislative Conference. The resolution called for broader involvement of the states. It was approved in October 1985.
	Governor Atiyeh spoke in support of a resolution on high-level waste transportation at the Western Governor's Association meeting. The resolution was approved.
September 1985	ODOE conducted the first comprehensive drill in Stanfield for a transportation accident involving radioactive material. Drills are now conducted every three to four months at different locations in Oregon.
	ODOE requested approval from the Legislative Emergency Board to accept further funds from Washington and to devote 2-1/4 additional persons to Hanford repository issues. The request was approved in October 1985. (Letter from Lynn Frank.)

October 1985	Oregon and Washington reached agreement on a joint review of the repository. Washington agreed to provide Oregon $100,000 for efforts from October 1985 to September 1986. Senator Hatfield added supporting language in US DOE's appropriations bill.
	The Legislative Interim Committee on Hazardous Materials was formed. The Committee decided to devote about half of its efforts to high-level waste issues. ODOE began working closely with the committee, including monthly presentations. (Memo to Bill Bradbury.)
	ODOE, Health Division, and ODOE's Hanford Advisory Committee sponsored a public workshop on radiation releases from Hanford last year.
	Oregon recommended and the Commercial Vehicle Safety Alliance approved a resolution calling for more state involvement in the transportation of high-level waste.
	Oregon proposed conditions for the planned shipments of spent nuclear fuel from Taiwan. US DOE agreed the conditions were reasonable. Since they were unable to meet the condition that the planned route is safe and economic, US DOE dropped their plans to ship through the Northwest.
November 1985	Health Division began devoting 1/4 of a person's time to high-level waste issues. This raised Oregon's effort to about 2 persons.
	ODOE took the Legislative Interim Committee on a tour of the Hanford repository and defense waste facilities.
	Oregon representative spoke at a national conference on high-level waste transportation sponsored by US DOE.
December 1985	Oregon provided US DOE with numerous concerns on the transportation of high-level wastes. (Letter to Philpott.)
January 1986	With ODOE's help, the appropriate legislative committees of Oregon and Washington and the affected Indian Tribes met to discuss mutual concerns about Hanford.
	ODOE hired a Hanford Coordinator, bringing Oregon's level of effort on high-level waste issues to about 3 persons.
	Oregon initiated a joint meeting with US DOE, the Navy, and the affected Indian Tribes to discuss a proposal to ship part of a decommissioned nuclear

	submarine to Hanford for disposal. All concerns were cooperatively resolved. The shipment took place in April 1986 without any major problems.
February, 1986	Governor Atiyeh met with US ODOE and the Navy to review the planned shipment of a submarine reactor compartment to Hanford. Governor Atiyeh also reviewed repository and defense waste concerns with US DOE. Governor Atiyeh asked US DOE to investigate secure, long-term funding for Oregon to more fully address our concerns.
	ODOE invited the affected Indian Tribes to establish liaisons with Oregon's Hanford Review Committee and Hanford Advisory Committee. The Umatilla Tribe has done so.
	ODOE and representatives from the Legislative Interim Committee met with the Yakima Tribe to discuss closer working relationships.
	ODOE's Hanford Advisory Committee held a public briefing on defense waste in Portland.
	ODOE worked with US DOE to provide public open houses on defense waste in The Dalles and Portland. Governor Atiyeh expressed Oregon's concerns in the introductory videotape.
	Oregon's Hanford Review Committee and Washington's Nuclear Waste Board held a joint meeting to discuss defense waste issues.
	Due in part to Oregon's and Washington's requests, US DOE declassified 40 years of data on radiation releases from Hanford. Governor Atiyeh decided to launch a review of this information, together with Washington and the affected Indian Tribes. A regional review committee was established. (Letter to Michael Lawrence.)
	Governor Atiyeh proposed joint letters from Oregon and Washington to US DOE and NRC . These letters called for more Hanford-related meetings being held in the Northwest. Governor Gardner agreed. (Letters to John Herrington and Nunzio Palladino.)
	The vice-chair of ODOE's Hanford Advisory Committee spoke before Washington's Advisory Council on cooperative efforts.
March 1986	Representatives from ODOE and the Legislative Interim Committee meet with the Umatilla Tribe to discuss closer working relationships.

	ODOE arranged for a briefing of the Legislative Interim Committee by the Western Interstate Energy Board on how to improve Oregon's liability laws for transportation accidents involving high-level waste.
April 1986	ODOE assisted US DOE in establishing the Northwest Citizens Forum on Defense Wastes. ODOE is providing staff support to the Oregon members.
	ODOE represented Oregon at a National Conference of State Legislators meeting on high-level waste issues.
	Governor Atiyeh directed ODOE to review the safety of the N Reactor at Hanford in light of the Russian reactor accident. (See attached workplan.)
May 1986	ODOE worked with the Western Interstate Energy Board on a resolution calling for independent reviews of the federal government's reactors.
	Governor Atiyeh asked the National Academies of Science and Engineering to work with Oregon on the review of N-Reactor safety.
	ODOE briefed the Oregon Congressional delegation on Hanford and high-level waste issues and asked for their continued support.
	Governor Atiyeh requested support from the Congressional delegation on funding to resolve Oregon's concerns about the proposed repository and defense waste at Hanford. (Letters to Senator Hatfield and Representative AuCoin.)
	ODOE's Hanford Advisory Committee conducted public workshops on defense wastes in Wilsonville and Pendleton. At Oregon's request, US DOE agreed to hold a public hearing on defense wastes in Portland during July.
	The Water Resources Department hired a geo-hydrologist dedicated to Hanford issues. This brought Oregon's effort on high-level waste issues to about 4 persons.
	President Reagan announced selection of Hanford as one of three sites for further study as a potential repository.

Prospective	Event
August 1986	Comments are due on the draft environmental impact statement for defense wastes.
1987	US DOE announces its decision on defense wastes.
1986-1994	US DOE's detailed characterization of the Hanford site will produce a broad range of site-specific data and information over the next five to eight years. To influence a final decision, Oregon must conduct a thorough and critical review of all issues covered by detailed studies produced by US DOE.
1991-1994	The President will select the first repository site.
1991-1998	If Hanford is selected for the first repository, Oregon must decide whether to influence Washington's authority to veto. If so, Oregon must work with Washington to prevent Congressional override. If not, Oregon must address and resolve any remaining concerns about site construction and operation. In either case, Oregon must resolve remaining concerns about transport of high-level wastes from Trojan and Hanford.
1998 At the Earliest	If Hanford is selected and the selection is upheld, transport and disposal of high-level wastes will begin.

BD/RMB:jt
310-Sitmisc (d2,f1)
06/02/86

June, 1986

OREGON'S INVOLVEMENT IN THE STORAGE, TRANSPORT, AND DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTES

Summary

For many years, Oregon has been concerned about the safe storage, transport, and disposal of radioactive wastes.

Prior to the 1980s most of Oregon's effort addressed these concerns generically. When the Trojan and Pebble Springs nuclear power plants were proposed, we reviewed whether spent nuclear fuel could be stored, transported, and disposed safely. We concluded that the technology either existed or was being developed. However, we recognized that there were huge institutional and political obstacles to overcome. Further, it is much easier to conclude that wastes can be disposed safely than to find a site for safe disposal.

In the 1980s our emphasis began to focus on Hanford, Washington. Forty years of defense wastes are stored there. And, Hanford began to emerge as a possible location for a repository to dispose of spent nuclear fuel from commercial power reactors.

We worked long and hard on influencing a national policy for disposing spent nuclear fuel. The Nuclear Waste Policy Act of 1982 is generally a good result of those efforts. We succeeded in gaining a role for the potential host states. But we failed to gain Congressional support for the role of affected adjacent states.

We did not give up. Despite being left out of the law, we have crafted a role for Oregon. Several times we asked the federal government for financial support. Each time we were refused. So, we made an agreement with Washington to provide some of their federal funds to us. That is an unusual achievement in interstate cooperation.

We have begun to exercise our influence in the process. But, it is a long process. Rather than opposing a repository at the outset, we chose a deliberate, long-range plan to gather the facts. We have grave concerns that Hanford is an acceptable location for a repository. An immediate denouncement would have played well in Oregon. It would, however, do little to influence others. We believe the technical facts will. And, we must be able to sway others, because the final battle will be fought in Congress.

We have also launched efforts to address clean-up of the defense wastes at Hanford. Again, this is not a decision that Oregon makes alone. We need the support of others to get the money to clean-up these wastes. We believe the technical facts will be persuasive.

We are committed to protecting Oregonians from the harms of high-level radioactive wastes. Although it will take time to see the results of our efforts, we are on the right course.

BD/RMB:jt
310-Sitmisc (d2,f1)
06/02/86

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CHRONOLOGY UPDATE
June 1986

Defense Wastes

- Oregon Hanford Review Committee met with the Washington Nuclear Waste Board on Defense Waste Issues.
- The Hanford Review Committee developed comments on the draft Defense Waste Environmental Impact Statement.
- Draft ODOE/Review Committee comments on the draft Defense Waste Environmental Impact Statement were sent to the ODOE Hanford Advisory Committee for review and comment.

Repository

- Governor Atiyeh announced his intent to take legal action on US DOE's decision to recommend Hanford for characterization.
- Oregon filed the first of two legal challenges to the Hanford selection.
- Governor Atiyeh met with Ben Rusche, US DOE in Washington, D.C. to request increased funding for Oregon.
- Governor Atiyeh requested funding support from the Congressional delegation.

July 1986

Defense Wastes

- ODOE prepared the Oregon position on disposal of the Hanford Defense Wastes. The position was developed using input from the ODOE Hanford Advisory Committee, the Hanford Review Committee, ODOE technical staff and members of the public.
- Governor Atiyeh announced the Oregon Defense Waste position.
- The Interim Committee on Hazardous Materials endorsed the Oregon position on defense waste.
- Lynn Frank, Director of the Oregon Department of Energy, representing Governor Atiyeh presented the Oregon Defense Waste position at the US DOE Public Hearing.

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- Congressmen Packwood, Wyden, Weaver and AuCoin testified at the US DOE Defense Waste public hearing.
- Senator Joyce Cohen testified at the Defense Waste public hearing on behalf of the Oregon Legislature supporting the Oregon position.
- Governor Atiyeh requested support from the Congressional delegation on funding for clean-up of defense wastes.

Repository

- Congressman Wyden initiated a letter to Ben Rusche indicating support for Oregon's direct funding request. The letter was signed by all Oregon members of the House of Representatives.
- At ODOE's initiation, the first joint Hanford Advisory Committee/Washington Advisory Council joint meeting was held.

Other Hanford Activities

- ODOE briefed the Legislative Interim Committee on Hazardous Materials on Repository and Defense Waste issues.
- Water Resources Department briefed PANDAH on ground water issues.
- ODOE continued to work with the Oregonian staff on technical points for the historical documents news stories.

August 1986

Defense Wastes

- Oregon comments on the draft Defense Waste Environmental Impact Statement were provided to US DOE.
- Oregon Congressional delegation proposed funding to begin clean-up of Defense Wastes.
- Congressman AuCoin proposed a plan to eliminate radioactive liquid discharge at Hanford.
- ODOE assisted the Northwest Citizen's Forum in adopting a position of defense waste consistent with Oregon's position.

N Reactor

- Governor Atiyeh requested Governor Gardner's support on safety improvements for N Reactor.
- Governor Atiyeh requested US DOE actions to improve the safety of N Reactor.

Chronology Update Continued
Page 3

- Congressman Weaver attempted to delete funding for N Reactor operation. Washington congressmen opposed this attempt. It was defeated.

- ODOE provided a report to Governor Atiyeh on N Reactor Safety.

- Governor Atiyeh requested support from the Congressional delegation for N Reactor safety. Senator Hatfield proposed a $20 million budget increase for safety. Senator Hatfield also proposed cutting funds to extend N Reactor's life beyond 1995.

Repository

- The Final Repository Environmental Assessment (E.A.) was sent to the Hanford Review Committee to confirm US DOE action on comments made on the draft E.A.

- The Congressional delegation initiated actions to require that the US DOE budget include $2.5 million over 5 years for an independent Oregon study.

- Congressman Weaver attempted to delete funding for the first repository. Although the Western states showed strong support, the attempt was soundly defeated.

- ODOE assisted with language for Congressman Wyden's Environmental Compliance Bill which would give EPA oversight authority over US DOE repository activities.

- Oregon Congressional delegation proposed cuts in repository funding.

- Congressmen Weaver and AuCoin introduced a bill to provide Oregon with the same rights as Washington for site selection review.

- Governor Atiyeh supported this bill.

- US DOE agreed to continue repository funding to Oregon via a Washington contract until Congress completes work on US DOE's budget.

Other Hanford Activities

- ODOE spoke on Hanford issues to the Portland City Club Environmental Committee.

- ODOE spoke on Hanford issues to the Salem Lions Club.

- ODOE spoke on Hanford issues to The Dalles Rotary Club.

- ODOE spoke on Hanford issues to the League of Oregon Cities.

- ODOE briefed Senator Packwood on Transportation issues.

- ODOE reported on Oregon Hanford activities at the Quarterly States and Tribes/US DOE meeting.

- ODOE accompanied Congressman Wyden on a tour of Hanford activities.

- Regional Hanford Historical Documents Review Committee and Environmental Monitoring Committee meetings to continue the review process of the 40 year data. Both groups reviewed questions to be posed to the Hanford Health Effects Panel. Selection of members for the panel was completed by the Centers for Disease Control.

September 1986

Defense Waste

- WRD and ODOE began work with US DOE and Washington State on Defense Waste technical issues. WRD and/or ODOE will participate in monthly Defense Waste meetings.

Repository

- ODOE and the Attorney Generals office went to the Emergency Board with a request for $200,000 to fund repository litigation. The request was approved.

- Congressman AuCoin asked US DOE for direct Oregon funding.

- US DOE agreed that Oregon should have funding. No direct grant mechanism is available now. No decision has been made on the level of funding.

- The Final Transportation Plan was released.

Other Activities

- ODOE wrote an article on Oregon Hanford activities for the bi-monthly Washington State newsletter.

- ODOE Hanford Advisory Committee met to discuss the long term role of the group.

- ODOE and representatives from the legislature toured Hanford. Defense waste, N Reactor and repository facilities were included in the tour.

- ODOE participated in the Hanford Historical Documents Review committee meeting. This group is evaluating the contractors draft report on the review of the 19,000 pages of historical data.

- The 13 member Hanford Health Effects Panel met in Richland Washington and OSHD presented Oregon concerns to the Panel. ODOE attended the panels deliberations and represented Governor Atiyeh at the report of findings.

- ODOE met with the Confederated Tribes of the Umatilla Reservation on socio-economic issues.

- ODOE represented Oregon at the NRC/DOE Management meeting.

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CHRONOLOGY UPDATE

October, 1986

Defense Waste

- ODOE met with Washington, US DOE, Rockwell, and Battelle, to begin resolution of Defense Waste issues. Monthly meetings will continue to evaluate US DOE proposed responses to over 2,000 public comments. Changes in the final EIS will be made from this input.
- Oregon Congressional delegation was successful in getting $20 million budget increase to begin clean-up of Defense Waste.

Repository

- Oregon helped cut the site characterization budget. No site specific work is authorized for fiscal year 1987.
- Congress approved direct funding to Oregon. US DOE is to give the State $2.5 million over the next five years. The first contract will begin January, 1987.
- US DOE's attempt to move jurisdiction of the litigation to Washington, D.C. failed. The case will be heard in the 9th Circuit Court in San Francisco.
- The Hanford Review Committee completed the final E.A. review. The Department is compiling the comments for submission to US DOE.
- The 1986 Annual Report of ODOE Hanford activities was completed. This report describes past activities and work done under the 1985-1986 Washington contract.

N-Reactor

- Oregon Congressional delegation was successful in denying funds to extend N-Reactor lifetime beyond 1995.
- Senator Hatfield was able to increase the N-Reactor budget for $20 million. This increase is for safety improvements.

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Other Activities

- The Regional Hanford Historical Documents Review Committee met. This group will request money from US DOE to fund health effects work. They will make health study recommendations to the Governors of Oregon, Washington, Idaho and the Indian Tribal Governments.
- ODOE wrote an article on the Oregon transportation program for the Washington State Newsletter.

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Chronology Update
November, 1986

Defense Waste

- US DOE gave a Defense Waste status report to the Joint Interim Committee on Hazardous Material. The Hanford Review Committee and the ODOE Hanford Advisory Committee were invited. Some members attended. The US DOE position on the preferred alternative was described. US DOE plans compatibility with the Oregon and N.W. Citizens Forum positions.
- ODOE participated in a US DOE/States/Tribes technical meeting on Defense Waste.
- ODOE worked with Washington and the Congressional delegation to insure 1987 defense waste funding. In spite of budget cuts, the Delegation was successful in maintaining $20 million for defense waste work.

Repository

- Oregon, Washington and Idaho joined to file a motion for discovery, with the 9th Circuit Court of Appeals. This motion asked for a broad order to allow the states to gather evidence for the lawsuit. It also asked the court to appoint a special master to set time tables.
- ODOE attended a US DOE legislative briefing on the repository decision methodology.
- The Congressional staff investigation report on the May 28 repository decision was released.

Other Activities

- ODOE accompanied Representative Wayne Fawbush on a tour of Hanford activities.
- ODOE spoke on Hanford issues to The Dalles Soroptomist Club.
- ODOE spoke on Hanford issues to the League of Oregon Cities.
- ODOE spoke on Hanford issues to Jefferson High School.
- ODOE met with the Umatilla Indian Tribe on socio-economic and environmental monitoring issues.
- ODOE spoke on Hanford issues to the Salem City Club.

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Chronology Update

December, 1986

Defense Waste

- N.W. Citizens Forum met to discuss US DOE progress on defense waste issues.

Repository

- US DOE approved direct funding assistance to Oregon. Over the next five years, Oregon will receive $500,000 per year to participate in the site characterization at Hanford.
- ODOE Geology and Hydrology technical staff met with US DOE Richland. The meeting was to help prepare for the Site Characterization Plan review.
- Dr. Ralph Keeney released a critique of techniques used to select three sites for characterization. Dr. Keeney is the developer and original author of US DOE's document on "Multi-attribute Utility Analysis."
- ODOE worked with Congressman Wyden's staff on proposed transportation legislation.
- ODOE worked with the Western Interstate Energy Board on routing and prenotification issues. The goal is multi-state cooperation on high-level radioactive shipments.
- ODOE worked with US DOT to develop workshops about radioactive material shipping.
- The Attorney General's office reviewed the preliminary staff investigation report. This report criticized the site selection process and the Recommendation Report drafting process.
- ODOE sent a request for proposal to prospective bidders. The proposal is to develop a formal public information program.

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N-Reactor

- The Roddis Panel report on N-Reactor safety were released. The reports recommend extensive safety improvements. The reports are in accord with findings ODOE made in August.
- ODOE began work to monitor safety improvements at N-Reactor over the next six months.
- National Academy of Science began a review of safety of N-Reactor. An interim report is expected in the Spring of 1987.
- ODOE gave testimony at the NAS public hearing on N-Reactor.
- ODOE was successful in getting a signed memorandum of understanding (MOU) between Oregon and US DOE Richland. The MOU covers emergency preparedness and response.

Other Activities

- Regional Hanford Historical Documents Review Committee met. The cost, scope and priorities of health studies is being evaluated.
- ODOE spoke on radioactive waste management and Hanford issues to the Washington County Public Affairs Forum.
- ODOE provided a briefing on Hanford issues to Central Willamette Valley legislators.
- ODOE worked with Washington State on routing of low-level radioactive waste shipments.

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CHRONOLOGY UPDATE
January, 1987

Defense Waste

- ODOE met with the Washington Defense Waste subcommittee. The group discussed the proposed Defense Waste Disposal Fee Allocation.

Repository

- Governor Goldschmidt sent testimony to the February 4 US Senate Energy Repository Hearing. The testimony described Oregon's position on the repository.
- US DOE released Chapters 1, 4 and Parts 8.6 and 8.7 of Chapter 8 of the draft Site Characterization Plan (SCP). The Hanford Review Committee began the technical review of the draft documents.
- US DOE released the Draft Mission Plan Amendment.
- The Nuclear Regulatory Commission released comments on the US DOE final Environmental Assessment.
- Draft Oregon comments on the final Environmental Assessment were completed. The draft was sent to the Hanford Review Committee and the ODOE Hanford Advisory Committee for review and comment.

Other Activities

- The Regional Hanford Historical Documents Review Committee met. The group is establishing a strong regional oversight role for dose reconstruction studies. The studies will determine the impact of past Hanford releases on Northwest citizens.
- ODOE began to organize emergency response drills in Deschutes/Jefferson, Douglas and Union Counties. Such drills are held regularly.
- Attorneys from Oregon, Washington and Idaho met. They discussed continued regional cooperation on litigation issues.

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- The Centers for Disease Control (CDC) requested comments on the draft Health Effects Panel Recommendation Report. The regional sponsors of the Panel were asked to review portions of the Draft written by CDC on behalf of the Region. The final Recommendation Report will be released in March.

- ODOE gave testimony in support of a bill to establish a western states agreement on radioactive materials transport.

- ODOE began negotiations with OSU on a subcontract for Hanford related work.

- ODOE spoke to students at McNary High School on Hanford issues.

- WRD participated in the US DOE/NRC Quarterly Management meeting.

- ODOE gave a Hanford Briefing to the Energy Facility Siting Council.

- ODOE spoke to Representative Sides breakfast meeting on Hanford issues.

- ODOE spoke to the Portland Jewish Community Center's Thursday Club on Hanford Issues.

Legislative Activities

- Senate Bill 13 -- Hanford Waste Board

  This bill would create an Oregon Hanford Waste Board. The board would recommend and act on the State's policy on the proposed repository.

  Members would come from ODOE, Water Resources, DEQ, Health Division, Geology, PUC, the Governor's Office, and the Umatilla Indians. One public member would serve as chairperson. Three state senators and four state representatives would serve as non-voting members of the board. The board would have a public advisory committee.

- Senate Bill 405 -- Hanford Challenge (requested by Gov. Goldschmidt)

  This bill directs the Legislature and state officials to continue challenges to the repository site selection process. It requires state officials to try to get status for Oregon equal to that of the potential host states.

The bill refers this measure to voters at the next special election. "Question: Shall state officials continue challenges to federal site selection process for high-level nuclear waste repositories and seek greater role for Oregon?"

- Senate Bill 406 -- Hanford Referendum (requested by Gov. Goldschmidt)

  This bill call for a special election on May 19, 1987, for the measure in Senate Bill 405.

- Senate Bill 408 -- Hanford Challenge

  This bill is almost identical to Senate Bill 405. Only a few words are different. It refers to US DOE's postponement of a "second" repository, rather than an "eastern" repository as in Senate Bill 405. Where it calls for Oregon to have the same status as potential host states, Senate Bill 405 calls for the same status "under federal law" as potential host states. In the discussion part of the ballot measure, it reads "Directs state officials to continue challenges . . ." Senate Bill 405 reads, "Directs state officials and agencies to continue challenges . . ."

- Senate Joint Memorial 1 -- N Reactor

  This memorial asks Congress to require US DOE to meet the safety concerns raised in ODOE's Report of N Reactor Safety.

- Senate Joint Memorial 2 -- Hanford Site Studies

  This memorial asks Congress to appropriate no more money for site studies of Hanford as a proposed repository.

- Senate Joint Memorial 3 -- Nuclear Waste Policy Act

  This memorial asks Congress to require the Secretary of Energy to comply with the Nuclear Waste Policy Act of 1982. If US DOE fails to comply, the bill asks Congress to give the responsibility for site selection to another agency.

- House Bill 2338 -- Radioactive Materials Transport Agreement

  This bill sets up an interstate agreement on radioactive materials transport. Similar bills are being introduced in the Washington and Idaho Legislatures. The agreement will take effect if two states pass the legislation.

  The bill sets up a panel with one member from each participating state. (Eight other western states are eligible to join.) The panel would recommend uniform transport regulations to each state's legislature. It also would coordinate emergency response planning among the states and share information.

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Chronology Update
February 1987

Defense Waste

- ODOE met with Washington and U.S. DOE on Defense Waste issues. An advanced copy of the final EIS will be provided to States and Tribes in April. Comments will be due in May.

- The Northwest Citizens Forum met with U.S. DOE on Defense Waste issues. The Forum Chairman gave a defense waste briefing to the Northwest Congressional Delegation in Washington, D.C.

- NRC released the Advance Notice of proposed rulemaking on the Definition of High Level Waste. The Hanford Review committee and ODOE will comment on the document.

- Western States, for a second time, met with Waste Isolation Pilot Project (WIPP) transport officials. The meeting was sponsored by the Western Interstate Energy Board High Level Waste Committee. The group is working on safety details for transport of transuranic wastes to New Mexico.

Repository

- ODOE and WRD attended the Quarterly meeting of States, Tribes and U.S. DOE. The Draft Mission Statement Amendment was discussed.

- The Draft Mission Plan Amendment was sent to the Hanford Review Committee for review and comment.

- ODOE attended meetings in Albuquerque, N.M. The meetings outlined Site Characterization Plan public information plans.

- ODOE gave testimony on HB 2338. The bill would establish an interstate commission to recommend consistent state regulations on transportation of high level waste.

- ODOE, WRD, and OSU attended the International Waste Management '87 Conference in Tucson, Arizona.

- Oregon comments on the final EA were sent to U.S. DOE.

- ODOE sent a letter to U.S. DOE requesting release of documents referenced in the Site Characterization Plan (SCP). Oregon involvement in U.S. DOE SCP technical meetings was also requested.

Legislative Activities

- Senate Bill 13 - Hanford Waste Board. Passed in the Senate. Now before the Ways and Means Committee.
- Senate Bill 405 - Hanford Challenge. Passed.
- Senate Bill 406 - Hanford Referendum. Passed.
- Senate Bill 407 - Hanford Referendum. Tabled - no further action.
- Senate Bill 408 - Hanford Challenge. Tabled - no further action.
- Senate Joint Memorial 1 - N Reactor. Passed.
- Senate Joint Memorial 2 - Hanford Site Studies. Passed.
- Senate Joint Memorial 3 - Nuclear Waste Policy Act. Passed.
- House Bill 2338 - Radioactive Materials Transport Agreement. Passed in the House. Now before the Senate Agriculture and Natural Resources Committee.

Other Activities

Hanford Historical Documents Review Committee (HHDRC)

- The HHDRC met to consider a joint Northwest Region/U.S. DOE dose reconstruction study. The group began negotiating with U.S. DOE to assure aggressive oversight by states and tribes.

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CHRONOLOGY UPDATE

March 1987

Defense Waste

- ODOE met with Washington and US DOE on Defense Waste issues. Oregon and the Indian Tribes will participate in future defense waste technical meetings.
- ODOE and WRD met with US DOE and Rockwell on the Grout disposal program. Grout performance assessment was reviewed.
- The Northwest Citizens Forum met with US DOE on Defense Waste. Mary Walker, US DOE, discussed the Defense Waste Budget and health and safety issues.

Repository

- Oregon comments on the draft Mission Statement Amendment were sent to US DOE.
- ODOE met with the Attorney General's office on litigation issues.
- A joint Washington/Oregon Advisory Committee meeting was held in Vancouver. About 75 members of the public attended the meeting.
- A joint Oregon/Hanford Review Committee/ODOE Hanford Advisory Committee meeting was held in Vancouver. US DOE gave a briefing on the Site Characterization Plan.
- ODOE attended the Washington Nuclear Waste Board meeting in Olympia.
- US DOE agreed to involve Oregon in Site Characterization Plan meetings.

N Reactor

- ODOE reviewed US DOE's N Reactor Accelerated Safety Enhancement Program Plan. The plan addressed most of Oregon's concerns. But, it was sketchy and without detail. It did not adequately resolve some concerns. Complete resolution of Oregon concerns would be costly and take a long time.

  Governor Goldschmidt's position is that the cost of resolution is not justified. He called for immediate and permanent shutdown of N Reactor.

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Legislature

- House Bill 2021 - Price Anderson Implementation - Passed the Judiciary Committee. The bill is now before the House.
- House Bill 2338 - Radioactive Materials Transport Agreement. The bill is now before the Senate Agriculture and Natural Resources Committee.
- Senate Bill 13 - The Hanford Waste Board bill is before the Ways and Means Committee.

Other Activities

Hanford Historical Documents Review Committee (HHDRC)

- The HHDRC met in Olympia. Negotiations for a joint dose reconstruction study continue. A group of thyroid experts are being selected. They will advise the HHDRC on if and how thyroid studies are to be done.

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CHRONOLOGY UPDATE

April 1987

Defense Waste

- ODOE met with US DOE on Defense Waste Issues.
- The US DOE "Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site" was released. It was sent to the Hanford Review Committee. ODOE reviewed the Plan. Comments on the plan were directed to the Congressional Delegation.
- ODOE reviewed US DOE Defense Waste Budget documents.

Repository

- The Hanford Review Committee met. The Site Characterization Plan Review was discussed.
- Oregon met with US DOE, States and Tribes on technical issues.
- ODOE and WRD met with US DOE and USNRC on hydrology questions.
- ODOE met with Washington and the Indian Tribes on transportation issues.
- ODOE provided a quarterly report to US DOE. The report described Oregon activities under the US DOE grant.
- ODOE gave a Hanford Status Report to the Energy Facility Siting Council.

Litigation

- ODOE met weekly with the Oregon litigation team.
- ODOE and the Attorney General's Office reviewed US DOE documents in Washington, D.C.

Legislative Activities

- Senate Bill 13 -- The Hanford waste board bill is before the Ways and Means Committee

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- House Bill 2021 -- Price-Anderson Implementation passed the House. The Senate Hearing is scheduled May 6.

- House Bill 2338 -- Radioactive Materials Transport Agreement. Governor Goldschmidt signed the bill into law April 18, 1987.

Other Activities

- ODOE spoke to the NW Metals and Minerals Conference on Hanford issues.

- ODOE met with the Hanford Historical Documents Review Committee thyroid experts.

- ODOE held a transportation emergency response drill in Jefferson County.

- ODOE participated in a transportation emergency response exercise in Douglas County.

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CHRONOLOGY UPDATE

May 1987

Defense Waste

- ODOE met with Washington and USDOE on defense waste issues.
- ODOE began preparation of comments to USNRC on the proposed definition of high level waste. The proposed definition would impact defense waste disposal.

Repository

- The Hanford Review Committee and ODOE Hanford Advisory Committee met. Members of the Confederated Tribes of the Umatilla Indian Reservation gave a briefing. Umatilla customs and perspective on repository issues were discussed.
- ODOE attended the Washington Nuclear Waste Board and Advisory Council meetings. Washington has received funds for and has hired a socio-economic contractor.
- ODOE, OWRD and DOGAMI staff attended the USDOE, States and Tribes quarterly meeting. The Site Characterization Plan release schedule was discussed.

Litigation Status

- Oregon and four others submitted briefs in support of Washington's motion for a judgment on the second site issue. The briefs were submitted to the ninth circuit court of appeals. The state of Nevada submitted a statement that it joined in Washington's brief.

Legislative Activities

- Senate Bill 13, the Oregon Nuclear Waste Board Bill will be considered by the full Ways and Means Committee early in June.

Other Activities

- ODOE participated in the Hanford Historical Documents Review Committee meeting in Pendleton. The states and tribes continue to negotiate with USDOE for health study funding.

- ODOE gave a Hanford status report to the Energy Facility Siting Council.

- ODOE and Health Division attended the Washington State Patrol critique of the response to the White Salmon train accident. The train contained a small quantity of radioactive material in one car. These materials were a small risk in the train derailment.

- ODOE spoke to a public health studies class at PSU on health hazards associated with Radon gas.

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Chronology Update
June 1987

Defense Waste

- ODOE met with Washington and US DOE on defense waste issues.

- ODOE provided technical comments to US NRC on the proposed definition of high level waste. A more broad scope comment document is being prepared.

- ODOE worked with congressional staff to increase US DOE funding for defense waste clean up.

Repository

- ODOE attended the Washington Nuclear Waste Board and Advisory Council meetings. Current Iodine 129 contamination of groundwater at Hanford was discussed.

- ODOE, OWRD and DOGAMI representatives participated in the quarterly meeting with US DOE, States and Tribes.

- OWRD attended a meeting with US DOE to discuss the grout disposal program.

- OWRD attended a meeting with US DOE on groundwater monitoring.

- ODOE and the Hanford Review Committee continue to review the first six chapters of the Site Characterization Plan.

Transportation

- ODOE and Washington co-sponsored a meeting with US DOE on shipments of transuranic wastes (plutonium) from Hanford to New Mexico.

- ODOE issued the annual radioactive materials transportation permits for 1987. Permits were issued in cooperation with PUC.

- ODOE provided technical assistance to carriers of radioactive materials about compliance with state and federal regulations.

- The Transportation Subcommittee of the Hanford Review Committee met. The Subcommittee agreed to develop an action plan to prepare for shipments from Hanford to New Mexico.

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Legislative Activities

- Senate Bill 13 -- The Hanford Waste Board Bill passed the House and Senate. The bill is before Governor Goldschmidt for signature.

- House Bill 2021 -- Price Anderson Implementation passed the House and Senate. The bill is before Governor Goldschmidt for signature.

Other Activities

- The Hanford Historical Documents Review Committee (HHDRC) negotiating team met. They have been successful in reaching agreement with US DOE on a joint dose reconstruction study. US DOE has also agreed to support further reasonable and feasible health studies.

- ODOE staff and a member of the Advisory Committee's Public Information Subcommittee will interview potential public information contractors on July 13. A contractor will be selected by July 31.

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07/08/87

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CHRONOLOGY UPDATE

July 1987

Defense Waste

- ODOE worked with US DOE to arrange a Review Committee status briefing. The group will meet with US DOE to resolve any disagreement on the EIS comment response document. This work will begin in August. The final EIS will be released in September.

Repository

- ODOE took part in the US DOE Institutional Socioeconomic coordinating group meeting in Seattle.
- ODOE took part in a transportation/socioeconomic meeting with States and Tribes.
- DOGAMI took part in a Geology field trip specific to BWIP.
- OWRD attended meetings on hydrology issues.
- ODOE prepared a Site Characterization Plan (SCP) issue paper. The paper will be sent to those on the ODOE mailing list.
- ODOE prepared a Hanford Briefing Book. The book will be offered to new Waste Board and Advisory members.
- ODOE submitted the Oregon 1987 second quarter report to US DOE.

Transportation

- ODOE worked with DEQ, EMD State Fire Marshals Office and Health Division to integrate the radiation transport safety program. This includes an application for federal Hazardous Material training money.
- ODOE began work on a transport emergency response drill. The drill will be held in La Grande in October.

Other Activities

- The Hanford Historical Documents Review Committee is working to establish a Technical Support Panel. The Panel will design and oversee the joint dose reconstruction work.
- ODOE is planning a tour of Hanford activities for new Board and Advisory members.

Congressional Activities

- Affected status for adjacent states passed the Senate Energy Committee. Senator Hatfield will continue to support special Oregon status in the Senate.

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OREGON POSITION
ON
DISPOSAL OF THE
HANFORD DEFENSE WASTES

August 1986

Prepared by:

The Oregon Department of Energy

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OREGON POSITION
ON
DISPOSAL OF THE HANFORD DEFENSE WASTES

In April 1986 the U.S. Department of Energy issued a draft environmental impact statement (EIS) on Hanford defense waste disposal. The draft EIS sets forth disposal options for radioactive wastes accumulated during four decades of weapons production at Hanford.

The ODOE Hanford Advisory Committee sponsored two public workshops to discuss and comment on EIS issues. The Hanford Review committee reviewed the draft EIS and also provided technical comments. These reviews and comments were used to develop the Oregon position.

The comments reflected the need for Oregon to take a strong position on deciding the permanent disposal of Hanford defense wastes. Our challenge is to obtain the necessary level of health and safety in the most cost effective way. Then, we must work to gain support for our position.

Basis for Oregon's Position

We must eliminate the long-term risks to public health and safety of defense wastes temporarily stored at Hanford. We should make decisions now that can be made now. Those wastes that are easily cleaned up should be. For those wastes for which we have the retrieval and disposal technology, and where current practices eventually will lead to leaks, we should take all reasonable actions to process and dispose of the waste.

Some wastes are difficult to deal with, but current storage poses no immediate problem. For those, we must develop greater confidence in our options. This process should be designed to take no more than the next five years. Our priority should be to avoid long term risks to ground water and the river. Research should be focused on ways to dispose of wastes by looking for innovative waste treatment techniques.

Based on these criteria, the Governor has taken this position on Hanford defense wastes.

1) Transform existing and future high-level liquid wastes into glass. Dispose of these wastes in a future geological repository.

2) Treat and ship post-1970 plutonium wastes (called transuranic [TRU] wastes) to the defense repository for plutonium wastes in New Mexico.

3) All other wastes must be better understood in terms of the trade-offs. Reasonable decisions must be made, but in light of the priorities mentioned above.

The various wastes are discussed below.

Double Shell Tanks contain high level liquids and suspended solids.

Option 1. Waste in these tanks could be retrieved, glassified and disposed in a future geologic repository. The plant to glassify these wastes could be completed by 1994. The cost of this option is about $877 million for existing waste, and $1.1 billion for future waste.

Option 2. Dried and stabilized waste could be disposed near ground surface. The waste could be covered with a rock and soil barrier to prevent flow of rainwater through the waste.

Oregon's Position

Oregon recommends option 1. This material is liquid high-level waste. If left in liquid form, these wastes eventually will leak. These wastes also are easily retrievable. They should be disposed in a geologic repository. This approach is consistent with standards for the commercial industry.

Single Shell Tanks contain solids in the form of sludge or salt cake. The radioactivity in this material is similar to the wastes in the double shell tanks. But, it is older and more dilute.

Option 1. The waste could be retrieved and separated into high-level and low-level waste. High-level waste could be converted to glass for future repository disposal. The low-level waste could be converted to a cement-like material and disposed on site.

Option 2. The waste could be stabilized in place. This treatment would include filling the empty space in tanks with crushed rock. The rainflow barrier described earlier would also be used.

Option 3. There is not enough information to choose now. We need a better understanding of the trade-offs and more confidence in the options before we decide.

Oregon's Position

Oregon recommends Option 3. The material in single shell tanks should be processed no matter what option is chosen. The best method is to retrieve and glassify it. But, this option involves tremendous cost and needless potential radiation exposure to workers. US DOE should investigate other cost effective means of retrieval. We believe this can be and should be achieved within five years.

The wastes in single shell tanks have been processed to reduce the water in them. This has reduced the possibility of leakage from deteriorating tanks. Thus, time spent to research disposal options will not significantly impact the environment in the near future.

If studies show that in-place stabilization is the best option for single shell tank wastes, engineered barriers should not be the only means of protecting public health and safety. Multiple barriers are needed. An example would be to mix the wastes within the tank with grout. Thus, they would not easily be dissolved in water if it entered the tank. Engineered barriers should be relied upon as a secondary level of protection.

Post-1970 Plutonium Contaminated Wastes consist of contaminated equipment and laboratory wastes. This waste has been stored for retrieval since 1970.

Option 1. Removal and treatment of the waste at Hanford. Eventual disposal at the defense repository for plutonium wastes in New Mexico. This would require a processing facility to be completed by 1990-1993. The cost of this option is $180 million.

Option 2. Near surface stabilization with a cement-like material. A barrier identical to that described in the second option for double shell tank waste will also be used.

Oregon's Position

Oregon recommends option 1. The storage of these wastes was designed for retrieval. These wastes pose an extremely long-term radiation hazard. They have been put in wooden boxes and steel drums and buried. The deterioration of these containers eventually will release contamination into the soil. They should be retrieved and disposed in the New Mexico repository.

Pre-1970 Plutonium Contaminated Waste consists of general trash, failed equipment, and 24 soil sites contaminated by releases directly to the ground. These wastes are not readily retrievable.

Option 1. Removal and treatment of buried solid waste and soil sites which exceed US DOE's classification for low-level plutonium contaminated waste. Treated waste could be shipped to the defense repository for plutonium wastes in New Mexico.

Option 2. Immobilization of the waste burial grounds by filling with a cement-like mixture. The area is to be covered with a rainflow barrier as previously described.

Option 3. There is not enough information to choose now. We need a better understanding of the trade-offs and more confidence in the options before we decide.

Oregon's Position

Oregon recommends Option 3. The wastes should be removed and treated if reasonably achievable. These wastes pose the same hazard as post-1970 contaminated waste and should be treated the same. If this goal cannot be achieved, more confidence in stabilizing the waste and confirmation of barrier protection must be accomplished. Again, this should be completed within five years.

These wastes have been buried for many years. Spending more time to research proper retrieval and disposal methods will not increase the the hazard within five years.

Strontium and Cesium wastes are double encapsulated in stainless steel cylinders. These wastes are stored in water basins.

Option 1. The capsules could continue to be stored in water basins. Capsules could then be packaged and shipped to a future geologic repository when a respository is available.

Option 2. Capsules could continue to be stored in water basins until 2010. Beginning in 2010, the capsules could be placed in a dry storage vault. A protective barrier as described earlier could be constructed over the site in the years 2013 to 2015.

Oregon's Position

Oregon recommends Option 1. Many of the capsules have been leased to industry for sterilization facilities and process control. The remainder is stored in water pools and is under constant attention. There is no immediate hazard from short-term storage of this waste. But, these capsules are highly radioactive and will remain so for hundreds of years. Eventual geologic disposal will provide safe long-term disposal.

Other Concerns

Oregon also has serious concerns about chemical waste and low level radioactive wastes from defense activities. USDOE's proposal does not deal effectively with these issues. But, they are potentially serious risks to public health and safety and the environment. Oregon supports

Congressional initiatives to direct US DOE to comply with current federal and state requirements on waste handling and disposal. A schedule of compliance should be drawn up and enforced. Congress must provide funding to achieve clean-up of these wastes as well. This funding should be provided before any of these actions are required by Congress.

Forty years of defense materials production has resulted in an enormous amount of radioactive wastes at Hanford. So much waste poses difficult and complex retrieval, processing, and disposal problems. Funding has been ample for the production of the defense materials but not for waste disposal. Oregon believes that funding policy is not acceptable. Congress requires the commercial nuclear industry to concurrently set aside funds for the disposal of radioactive wastes as they are generated. USDOE also should be subject to this requirement. Plutonium production should not be allowed without concurrently providing funding to dispose of generated wastes.

Governor Atiyeh will be working with Oregon's Congressional delegation to see that these actions are carried out.

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NOTE: This paper will be the executive summary for the State of Oregon's technical and public comments on the Draft EIS. These formal comments will be submitted to US DOE on or before August 9, 1986.

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64th OREGON LEGISLATIVE ASSEMBLY--1987 Regular Session

B-Engrossed

Senate Bill 13

Ordered by the Senate June 11
Including Senate Amendments dated February 10 and June 11

PRINTED PURSUANT TO ORS 171.130 by order of the President of the Senate in conformance with presession filing rules, indicating neither advocacy nor opposition on the part of the President (at the request of Joint Interim Committee on Hazardous Materials)

SUMMARY

The following summary is not prepared by the sponsors of the measure and is not a part of the body thereof subject to consideration by the Legislative Assembly. It is an editor's brief statement of the essential features of the measure.

Creates Oregon Hanford Waste Board. Prescribes duties and powers of board. [*Appropriates money.*] **Limits biennial expenditures from moneys or other revenues, including Miscellaneous Receipts, excluding federal funds, collected or received by board to $141,222.**
Declares emergency, effective on passage.

A BILL FOR AN ACT

Relating to radioactive wastes; limiting expenditures; and declaring an emergency.

Be It Enacted by the People of the State of Oregon:

SECTION 1. (1) The Legislative Assembly finds and declares that Oregon is not assured that the United States Department of Energy will:

(a) Consider the unique features of Oregon and the needs of the people of Oregon when assessing Hanford, Washington, as a potentially suitable location for the long-term disposal of high-level radioactive waste; or

(b) Insure adequate opportunity for public participation in the assessment process.

(2) Therefore, the Legislative Assembly declares that it is in the best interests of the State of Oregon to establish an Oregon Hanford Waste Board to serve as a focus for the State of Oregon in the development of a state policy to be presented to the Federal Government, to insure a maximum of public participation in the assessment process.

SECTION 2. Nothing in sections 1 to 16 of this Act shall be interpreted by the Federal Government or the United States Department of Energy as an expression by the people of Oregon to accept Hanford, Washington, as the site for the long-term disposal of high-level radioactive waste.

SECTION 3. As used in sections 1 to 16 of this Act:

(1) "Board" means the Oregon Hanford Waste Board.

(2) "High-level radioactive waste" means fuel or fission products from a commercial nuclear reactor after irradiation that is packaged and prepared for disposal.

(3) "United States Department of Energy" means the federal Department of Energy established under 42 U.S.C.A. 7131 or any successor agency assigned responsibility for the long-term disposal of high-level radioactive waste.

SECTION 4. There is created an Oregon Hanford Waste Board which shall consist of the following members:

(1) The Director of the Oregon Department of Energy or designee;

(2) The Water Resources Director or designee;

NOTE: Matter in bold face in an amended section is new; matter [*italic and bracketed*] is existing law to be omitted.

(3) The Director of the Department of Environmental Quality or designee;

(4) The Assistant Director for Health or designee;

(5) The State Geologist or designee;

(6) A representative of the Public Utility Commission who has expertise in motor carriers;

(7) A representative of the Governor;

(8) One member representing the Confederated Tribes of the Umatilla Indian Reservation;

(9) One member of the public, appointed by the Governor subject to confirmation by the Senate in the manner provided in ORS 171.562 and 171.565, who shall serve as chairperson;

(10) Two members of the public advisory committee created under section 9 of this Act, selected by the public advisory committee; and

(11) Three members of the Senate, appointed by the President of the Senate, and three members of the House of Representatives, appointed by the Speaker of the House of Representatives who shall serve as advisory members without vote.

SECTION 5. (1) Each member of the Oregon Hanford Waste Board shall serve at the pleasure of the appointing authority. For purposes of this subsection, for those members of the board selected by the public advisory committee, the appointing authority shall be the public advisory committee.

(2) Each public member of the board shall receive compensation and expenses as provided in ORS 292.495. Each legislative member shall receive compensation and expenses as provided in ORS 171.072.

(3) The board shall be under the supervision of the chairperson.

SECTION 6. The Oregon Hanford Waste Board:

(1) Shall serve as the focal point for all policy discussions within the state government concerning the disposal of high-level radioactive waste in the northwest region.

(2) Shall recommend a state policy to the Governor and to the Legislative Assembly.

(3) After consultation with the Governor, may make policy recommendations on other issues related to the United States Hanford Reservation at Richland, Washington, including but not limited to defense wastes, disposal and treatment of chemical waste and plutonium production.

SECTION 7. In carrying out its purpose as set forth in section 6 of this Act, the Oregon Hanford Waste Board shall:

(1) Serve as the initial agency in this state to be contacted by the United States Department of Energy or any other federal agency on any matter related to the long-term disposal of high-level radioactive waste.

(2) Serve as the initial agency in this state to receive any report, study, document, information or notification of proposed plans from the Federal Government on any matter related to the long-term disposal of high-level radioactive waste. Notification of proposed plans includes notification of proposals to conduct field work, onsite evaluation or onsite testing.

(3) Disseminate or arrange with the United States Department of Energy or other federal agency to disseminate the information received under subsection (2) of this section to appropriate state agencies, local governments, regional planning commissions, American Indian tribal governing bodies, the general public and interested citizen groups who have requested in writing to receive this information.

(4) Recommend to the Governor and Legislative Assembly appropriate responses to contacts under subsection (1) of this section and information received under subsection (2) of this section if a response is appropriate. The board shall consult with the appropriate state agency, local gov-

ernment, regional planning commission, American Indian tribal governing body, the general public and interested citizen groups in preparing this response.

(5) Promote and coordinate educational programs which provide information on the nature of high-level radioactive waste, the long-term disposal of this waste, the activities of the board, the activities of the United States Department of Energy and any other federal agency related to the long-term disposal of high-level radioactive waste and the opportunities of the public to participate in procedures and decisions related to this waste.

(6) Review any application to the United States Department of Energy or other federal agency by a state agency, local government or regional planning commission for funds for any program related to the long-term disposal of high-level radioactive waste. If the board finds that the application is not consistent with the state's policy related to such waste or that the application is not in the best interest of the state, the board shall forward its findings to the Governor and the appropriate legislative committee. If the board finds that the application of a state agency is not consistent with the state's policy related to long-term disposal of high-level radioactive waste or that the application of a state agency is not in the best interest of the state, the findings forwarded to the Governor and legislative committee shall include a recommendation that the Governor act to stipulate conditions for the acceptance of the funds which are necessary to safeguard the interests of the state.

(7) Monitor activity in Congress and the Federal Government related to the long-term disposal of high-level radioactive waste.

(8) If appropriate, advise the Governor and the Legislative Assembly to request the Attorney General to intervene in federal proceedings to protect the state's interests and present the state's point of view on matters related to the long-term disposal of high-level radioactive waste.

SECTION 8. The chairperson of the Oregon Hanford Waste Board shall:

(1) Supervise the day-to-day functions of the board;

(2) Hire, assign, reassign and coordinate the administrative personnel of the board, prescribe their duties and fix their compensation, subject to the State Personnel Relations Law; and

(3) Request technical assistance from any other state agency.

SECTION 9. (1) There is created a public advisory committee which shall consist of not less than 15 members to advise the Oregon Hanford Waste Board on the development and administration of the policies and practices of the board. Members shall be appointed by the Governor and shall serve a term of two years.

(2) Advisory committee members shall be selected from all areas of the state and shall include a broad range of citizens, representatives of local governments and representatives of other interests as the Governor determines will best further the purposes of this Act.

(3) Members of the advisory committee shall receive no compensation for their services. Members of the advisory committee other than members employed in full-time public service shall be reimbursed for their actual and necessary expenses incurred in the performance of their duties. Such reimbursements shall be subject to the provisions of ORS 292.210 to 292.288. Members of the advisory committee who are employed in full-time public service may be reimbursed for their actual and necessary expenses incurred in the performance of their duties by their employing agency.

(4) The advisory committee shall meet at least once every three months.

SECTION 10. (1) If the United States Department of Energy selects Hanford, Washington, as the site for the construction of a repository for the long-term disposal of high-level radioactive waste, the Oregon Hanford Waste Board shall review the selected site and the site plan prepared by the United States Department of Energy. In conducting its review the board shall:

(a) Include a full scientific review of the adequacy of the selected site and of the site plan;

(b) Use recognized experts;

(c) Conduct one or more public hearings on the site plan;

(d) Make available to the public arguments and evidence for and against the site plan; and

(e) Solicit comments from appropriate state agencies, local governments, regional planning commissions, American Indian tribal governing bodies, the general public and interested citizen groups on the adequacy of the Hanford site and the site plan.

(2) After completing the review under subsection (1) of this section, the board shall submit a recommendation to the Speaker of the House of Representatives, the President of the Senate and the Governor on whether the state should accept the Hanford site.

SECTION 11. (1) In addition to any other duty prescribed by law and subject to the policy direction of the board, a lead agency designated by the Governor shall negotiate written agreements and modifications to those agreements, with the United States Department of Energy or any other federal agency or state on any matter related to the long-term disposal of high-level radioactive waste.

(2) Any agreement or modification to an agreement negotiated by the agency designated by the Governor under subsection (1) of this section shall be consistent with the policy expressed by the Governor and the Legislative Assembly as developed by the Oregon Hanford Waste Board.

(3) The Oregon Hanford Waste Board shall make recommendations to the agency designated by the Governor under subsection (1) of this section concerning the terms of agreements or modifications to agreements negotiated under subsection (1) of this section.

SECTION 12. The Oregon Hanford Waste Board shall implement agreements, modifications and technical revisions approved by the agency designated by the Governor under section 11 of this Act. In implementing these agreements, modifications and revisions, the board may solicit the views of any appropriate state agency, local government, regional planning commission, American Indian tribal governing body, the general public and interested citizen groups.

SECTION 13. The Oregon Hanford Waste Board may accept moneys from the United States Department of Energy, other federal agencies, the State of Washington and from gifts and grants received from any other person. Such moneys are continuously appropriated to the board for the purpose of carrying out the provisions of this Act. The board shall establish by rule a method for disbursing such funds as necessary to carry out the provisions of sections 1 to 16 of this Act, including but not limited to awarding contracts for studies pertaining to the long-term disposal of radioactive waste. Any disbursement of funds by the board or the lead agency shall be consistent with the policy established by the board under section 6 of this Act.

SECTION 14. In addition to the public advisory committee established under section 9 of this Act, the Oregon Hanford Waste Board may establish any advisory and technical committee it considers necessary. Members of any advisory or technical committee established under this section may receive reimbursement for travel expenses incurred in the performance of their duties in accordance with ORS 292.495.

SECTION 15. All departments, agencies and officers of this state and its political subdivisions shall cooperate with the Oregon Hanford Waste Board in carrying out any of its activities under sections 1 to 16 of this Act and, at the request of the chairperson, provide technical assistance to the board.

SECTION 16. In accordance with the applicable provisions of ORS 183.310 to 183.550, the Oregon Hanford Waste Board shall adopt rules and standards to carry out the requirements of sections 1 to 16 of this Act.

SECTION 17. Notwithstanding any other law, the amount of $141,222 is established for the biennium beginning July 1, 1987, as the maximum limit for the payment of expenses from moneys or other revenues, including Miscellaneous Receipts, excluding federal funds, collected or received by the Oregon Hanford Waste Board.

SECTION 18. This Act being necessary for the immediate preservation of the public peace, health and safety, an emergency is declared to exist, and this Act takes effect on its passage.

64th OREGON LEGISLATIVE ASSEMBLY–1987 Regular Session

Senate Bill 405

Sponsored by Senator WYERS, Representative FAWBUSH, Senators BRADBURY, BRENNEMAN, BROCKMAN, CEASE, COHEN, DUKES, FRYE, HAMBY, HANNON, J. HILL, L. HILL, HOUCK, JERNSTEDT, KENNEMER, KERANS, KINTIGH, KITZHABER, McCOY, MEEKER, MONROE, OLSON, OTTO, ROBERTS, RYLES, SIMMONS, THORNE, TIMMS, TROW, YIH, Representatives AGRONS, BARILLA, BAUMAN, BUNN, BURTON, CARTER, CEASE, DIX, DWYER, EACHUS, GILMOUR, GOLD, HOOLEY, HOSTICKA, HUGO, JOLIN, KATZ, KOPETSKI, KOTULSKI, MARKHAM, MASON, McCARTY, McCRACKEN, McTEAGUE, PARKINSON, PETERSON, PICKARD, ROBERTS, SCHOON, SOWA, SPRINGER, VAN VLIET, WHITTY, YOUNG (at the request of Governor Neil Goldschmidt)

SUMMARY

The following summary is not prepared by the sponsors of the measure and is not a part of the body thereof subject to consideration by the Legislative Assembly. It is an editor's brief statement of the essential features of the measure as introduced.

Directs legislature and state officials to continue challenges to site selection process for high-level nuclear waste repository. Requires state officials to attempt to obtain status for Oregon in proceeding equal to status of state in which proposed high-level nuclear waste repository is located. Refers measure to voters at next special election.

A BILL FOR AN ACT

Relating to the site selection process for a high-level nuclear waste repository; creating new provisions; and providing that this Act be referred to the people for their approval or rejection.

Be It Enacted by the People of the State of Oregon:

SECTION 1. The Legislative Assembly and the people of the State of Oregon find that:

(1) In order to solve the problem of high-level radioactive waste disposal, Congress established a process for selecting two sites for the safe, permanent and regionally equitable disposal of such waste.

(2) The process of selecting three sites as final candidates, including the Hanford reservation in the State of Washington, for a first high-level nuclear waste repository by the United States Department of Energy violated the intent and the mandate of Congress.

(3) The United States Department of Energy has prematurely deferred consideration of numerous potential sites and disposal media that its own research indicates are more appropriate, safer and less expensive.

(4) Placement of a repository at Hanford without methodical and independently verified scientific evaluation threatens the health and safety of the people and the environment of this state.

(5) The selection process is flawed and not credible because it did not include independent experts in the selection of the sites and in the review of the selected sites, as recommended by the National Academy of Sciences.

(6) By postponing indefinitely all site specific work for an eastern repository, the United States Department of Energy has not complied with the intent of Congress expressed in the Nuclear Waste Policy Act, Public Law 97-425, and the fundamental compromise which enabled its enactment.

SECTION 2. In order to achieve complete compliance with federal law and protect the health, safety and welfare of the people of the State of Oregon, the Legislative Assembly, other state-wide officials and state agencies shall use all legal means necessary to:

(1) Suspend the preliminary site selection process for a high-level nuclear waste repository, including the process of site characterization, until there is compliance with the intent of the Nuclear

NOTE: Matter in **bold face** in an amended section is new; matter *[italic and bracketed]* is existing law to be omitted.

Waste Policy Act;

(2) Reverse the Secretary of Energy's decision to postpone indefinitely all site specific work on locating and developing an eastern repository for high-level nuclear waste;

(3) Insist that the United States Department of Energy's site selection process, when resumed, considers all acceptable geologic media and results in safe, scientifically justified and regionally and geographically equitable high-level nuclear waste disposal;

(4) Demand that federal budget actions fully and completely follow the intent of the Nuclear Waste Policy Act;

(5) Continue to pursue alliances with other states and interested parties, particularly with Pacific Northwest Governors, legislatures and other parties, affected by the site selection process and transportation of high-level nuclear waste; and

(6) Assure that Oregon, because of its close geographic and geologic proximity to the proposed Hanford site, be accorded the same status under federal law as a state in which a high-level nuclear repository is proposed to be located.

SECTION 3. Within 10 days after the effective date of this Act, the Secretary of State shall transmit copies of this Act, including the voter referendum results, to the President of the United States, the United States Department of Energy, the President of the United States Senate, the Speaker of the House of Representatives, each member of Congress and the Governors and legislatures of the other 49 states.

SECTION 4. The ballot title for the measure referred to in section 5 of this Act shall be:

STATE ROLE IN SELECTION
OF HIGH-LEVEL NUCLEAR
WASTE REPOSITORY SITE

Question: Shall state officials continue challenges to federal selection process for high-level nuclear waste repositories and seek a greater role for Oregon?

Purpose: Directs state officials and agencies to continue activities to challenge federal selection process for high-level nuclear waste repositories. Directs state officials and agencies to seek status for Oregon that would allow Oregon a greater role in the process of selecting high-level radioactive waste repository.

SECTION 5. This Act shall be submitted to the people for their approval or rejection at the next special election held throughout the state.

ADDITIONAL INFORMATION SUBMITTED FOR THE RECORD

STATE OF WASHINGTON

July 16, 1987

STATEMENT OF GOVERNOR BOOTH GARDNER
STATE OF WASHINGTON

to the

HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT

September 18, 1987

Thank you Chairman Udall and members of the Subcommittee. I appreciate the opportunity to present this testimony on behalf of the citizens of the state of Washington. This Subcommittee and especially you, Chairman Udall, have demonstrated such leadership in the effort to find a solution to the nation's high-level nuclear disposal problem.

When Congress passed the Nuclear Waste Policy Act, it was generally agreed that it established an effective and workable means to solve this critical problem facing the nuclear industry and the nation as a whole. In my opinion, the Act did contain all of the necessary elements to solve the problem if properly implemented. However, the seriously flawed implementation of the Act by USDOE has resulted in an untenable situation which now requires Congress to develop the elements of a mid-course correction.

The primary purpose of my testimony is to support legislative action that I believe would substantially increase the likelihood of the ultimate success of the nuclear waste program.

I have also attached a postscript to my testimony to help the Subcommittee understand why we in the state of Washington are so adamant on our position that the site selection process must be brought to a halt, the May 28th decisions must be retracted, and the process must be restructured before the program goes forward.

How To Fix the Program

Before we can be confident that the site selection process will be successful, there must be agreement on several major questions which we thought were answered more than four years ago in the NWPA.

Three major issues--short-term waste management, need for and timing of a second repository, and a credible siting process--must be resolved together in order to develop a credible overall solution to the nation's high-level nuclear waste disposal problem. There are no "*quick fixes*" which can restore credibility to the current site selection process. In order to maximize the potential for ending up with a complete package which will work, each of the interests must have the opportunity to participate in putting it together. If the parties act in good faith with the common goal of seeking a solution to the nation's nuclear waste problems, I am optimistic that a consensus can be reached. H.R.2888 and H.R.2967 provide the opportunity.

The Moratorium and Commission Bills Will Right the Process

The state of Washington, as well as the Western Governors Association are on record in support of legislation which would bring the site selection process to a temporary halt, providing an opportunity for Congress to forge a mid-course correction. This is consistent with the approach taken in H.R.2967 and H.R.2888. I suggest that legislation Congress enacts to implement the moratorium approach be designed to accomplish the following:

- Establish a commission of policy leaders who are widely respected for their independence and good judgment, and whose recommendations will have credibility and a high likelihood of acceptance;
- Charge the commission with developing recommendations to Congress as to the preferred solution to the short-term storage problem, and as to actions needed to provide confidence that the best repository site will be chosen based on credible scientific evidence.
- Allow sufficient time and provide enough flexibility for the commission to request that representatives of all interests present their points of view and the rationale therefor on the major issues to be resolved, as well as comment critically on others' points of view;
- Provide sufficient resources to enable the commission to assemble its own excellent staff or consultant support to compile the available information and to conduct independent study and analysis to the extent the commission deems necessary.

There is widespread agreement that the repository site selection process is headed for failure and that there is a need for a mid-course correction. During the moratorium, the commission must conduct a comprehensive review of the process and identify modifications which would substantially increase the likelihood of the ultimate success of the program.

If the commission conducts a fair and open process which allows adequate opportunity for participation by all of the interests, its final recommendations to Congress should be acceptable to those who participate with a good faith intent to solve the nation's nuclear waste problem.

The comprehensive recommendation from the commission to Congress must suggest action to resolve the utilities' short-term storage problem, as well as the nation's permanent disposal problem.

Currently, there is serious disagreement among the interests as to the best approach to resolve the utilities' short-term storage problem. Congress has not established a policy on this issue and there is a need for Congress to do so as a major element of the mid-course correction. In order to assist Congress in making a well informed policy decision, I suggest that the commission be directed to:

- Conduct an independent assessment of the extent and anticipated timing of the utilities' short-term storage problem--that is, over the next 20 to 25 years which commercial reactors will run out of storage space in their cooling pools and when is this expected to occur?
- Compare and evaluate the relative merits and shortcomings of the several proposed solutions to the short-term problem:
  - -- USDOE MRS facility
  - -- A system of regional MRS facilities
  - -- At-reactor dry cask storage

We suggest that the commission utilize the following criteria in comparing and evaluating the alternative proposed solutions to the short-term storage problem:

1. Is the alternative technically achievable with a high level of confidence that it is acceptably safe? This, of course, is a threshold question which must be answered "yes" before an alternative would merit further consideration.
2. Is one of the alternatives significantly safer than the others?
3. What are the comparative effects on overall nuclear waste storage and disposal system costs?
4. What are the likely impacts of each alternative on achieving permanent disposal?

Negotiator, Incentives Should Be Considered

Turning now to that portion of Chairman Udall's legislation which would establish a nuclear waste negotiator, I believe the concept and the purpose are good. If there are states or Indian Nations with potential repository sites which, based on existing knowledge, appear to be suitable and if the elected leaders and the citizens are willing to offer those sites for characterization in exchange for incentive payments which are agreeable to Congress, this could constitute a significant step towards resolving the site selection problems. The negotiator should be instructed to provide a timely report of the negotiation efforts to the commission assembled pursuant to the moratorium legislation. The commission could then take the results of the negotiation efforts into consideration in its final comprehensive recommendations to Congress.

Finally, I would like to comment briefly on S.1668. Although this legislation is not before the subcommittee, it is an approach which has attracted much attention and which has passed out of the Senate Committee on Energy and Natural Resources. This approach would direct the Secretary of Energy to choose for sequential characterization the Texas, Nevada, or Washington site--sites that were selected as the result of USDOE's seriously flawed implementation of the NWPA. This legislation also would legitimize USDOE's unlawful postponement of the second round site selection process. The supporters of this approach perceive it as a means to reduce overall program costs and to avoid a delay in the site selection process. Given the serious political, technical and legal problems upon which the process is built, however, this approach would face a high risk of a total collapse in the future, resulting in increased costs and longer delays. Finally, this approach attempts to force one of three states whose marginal sites were selected in an unfair, non-scientific process, to host the nation's high-level nuclear waste repository. This is neither fair nor scientific, and for those reasons I do not believe it can succeed.

If the repository program is to succeed at the end of the site selection process, the Governor or Tribal Chairman and other elected and non-elected community leaders must be able to make a statement to the citizens similar to the following:

> The nation has a critical problem which must be solved. We must locate a safe place to permanently dispose of high-level nuclear waste. The federal government has conducted a fair, open and scientific search across the country and it turns out that we have the best site. Based upon the results of the scientific studies, I am convinced that it will be a safe site. As compensation for providing this valuable service to the

> rest of the nation, our state will receive generous financial rewards, to which we are certainly entitled. We would not have volunteered to provide this service, but we have been drafted to do so because of geologic and hydrologic conditions. My recommendation is that we accept this responsibility.

I believe that most government leaders would be willing and able to make such a speech, if a scientifically-based site selection process was implemented in an open and equitable manner. I hope that in the not too distant future it will happen.

Chairman Udall, you are once again providing leadership by sponsoring legislation to put the site selection process onto the right track. I also want to take this opportunity to thank Congressman Swift for his effort in helping to attract such widespread support for this approach. A moratorium and commission review now will positively, if ironically, save time and effort, and improve our chance of success in solving the nuclear waste problem.

I look forward to working with this subcommittee in your effort to develop a solution to this national problem. On behalf of the citizens of the state of Washington, thank you once again for this opportunity to present our perspective.

Postscript: Why We Have To Make the Mid-Course Correction Now

Our state's perspective is that USDOE's implementation of the site selection process over the past four and one-half years makes a halt and renegotiation of the key issues essential. As one of the three states with a designated potentially suitable site, we have of course been very deeply involved in this process. As we have expressed our serious concerns, some interested parties have initially mistaken our concerns as simply evidence of the NIMBY syndrome. However, after they examined and understood the rationale upon which our concerns are based, most of these parties agree that our complaints are justified.

It has now been a year and a half since USDOE, in direct violation of the Nuclear Waste Policy Act, announced its unilateral and arbitrary decision to "indefinitely postpone" the second round site selection process. In the intervening months, USDOE has conceded that it did not have the authority to take this action. An old saying holds that "Time heals all wounds". The severe wounds resulting from USDOE's unlawful act must be treated before the process can be healed. As the members of this Subcommittee know as well as anyone, the second repository was a significant element in the delicate regional balance which resulted in passage of the Nuclear Waste Policy Act. In fairness, this element cannot be discarded without exploring other avenues to equity among regions.

Let me turn now to the first round site selection process. In selecting Hanford as one of the three sites to be characterized, USDOE ignored the results of its own ranking methodology, which was reviewed and approved by the National Academy of Sciences. (It is important to note that the National Academy did not review or approve the way in which USDOE utilized the results of the ranking methodology to select the three sites for characterization.) The results of the ranking methodology, based on USDOE's own studies and judgments, indicate that the Hanford site is the most costly and least safe site of the five sites under consideration. Hanford ranks dead last in both the pre-closure and the post-closure comparisons of the sites.

USDOE says Hanford was selected to meet diversity of rock type requirements. However, in a draft of the USDOE ranking methodology report prepared just six weeks prior to the May 28th announcement, it was stated that the Yucca Mountain, Richton Dome, and Deaf Smith sites "offer maximum diversity in geohydrologic settings", and that their selection would "meet the minimum requirement for [rock type] diversity of the Nuclear Regulatory Commission".

In a subsequent USDOE draft, it was stated as follows:

> *"The clear implication from the composite analysis is that Yucca Mountain, Richton Dome, and Deaf Smith are the preferred set of sites for characterization. There are no realistic assumptions about either pre-closure or post-closure expected performance, or about the values used to evaluate performance that can result in Hanford being anything but the last ranked site. And the significance of the performance differences between Hanford and all the other sites is substantial. . . .Thus, it can be definitively stated that the results of the composite analysis strongly suggest characterization of the Yucca Mountain, Richton Dome, and Deaf Smith sites."*

Professor Ralph Keeney was a co-author of the ranking methodology utilized by USDOE. Dr. Keeney was retained by USDOE because of his experience in utilizing the methodology for similar or related problems. Prior to the May 28th decision, Professor Keeney recommended to USDOE that the appropriate means to identify the best suite of three sites was to conduct a professional portfolio analysis. USDOE chose not to follow Professor Keeney's recommendation. Subsequent to the May 28th decision, Professor Keeney prepared and published such a portfolio analysis. This work was not funded by USDOE. Based on his portfolio analysis, Professor Keeney concluded that if three sites are to be characterized they should be Yucca Mountain, Richton Dome, and Deaf Smith.

Professor Detlof von Winterfeldt was retained by the National Academy of Sciences to assist them in their review of the USDOE ranking methodology. Professor von Winterfeldt is nationally known and respected in the field of decision analysis. Subsequent to the May 28th decisions, Professor von Winterfeldt conveyed his individual comments to Mr. Rusche on the USDOE ranking methodology report and on the USDOE recommendation report, which presented USDOE's rationale for its selection of the three sites for further study. Professor von Winterfeldt said that, in his opinion, the analysis in the ranking methodology report is sound, thorough, and state-of-the-art. However, as to the recommendation report, he stated the following:

> *"In brief, I believe that the conclusions drawn in the Recommendation Report are based on selective and misleading use of the analysis described in the Methodology Report. It is extremely hard to find in the Methodology Report any support for the selection of the specific set of three sites recommended for characterization. Instead, I find a convincing analysis that clearly rejects the Hanford site and, furthermore, supports the selection of the Richton Dome site over the Deaf Smith site. The way the Methodology Report was interpreted in the Recommendation Report, in my opinion, comes very close to a misuse of an otherwise excellent analysis."*

In his conclusion, Professor von Winterfeldt stated as follows:

> *". . .The most important conclusion that I draw from the Recommendation Report's inclusion of the Hanford and Deaf Smith sites is that DOE is apparently willing to accept more health effects and an additional cost of $3.360 billion in return for several minor*

advantages of the two sites. As a decision analyst, I find these implications inconsistent with the Methodology Report. As a concerned member of the public and a taxpayer, I find them irresponsible."

Neither of these distinguished experts in the field of decision analysis had an ax to grind in the site selection process. They both had been involved in the decision-making process in different roles and when USDOE announced its decision on May 28th, they both felt compelled to go on the public record with their own analysis of the decision.

I hope this brief summary concerning USDOE's application of the ranking methodology helps you to understand part of the reason why the citizens of the state of Washington are extremely upset about the site selection process. This is by no means a comprehensive discussion of our concerns. We have serious technical concerns as well. Hanford is the only saturated site under consideration. There is serious disagreement among experts as to whether the Hanford site can satisfy NRC's one thousand year groundwater travel time test. An NRC consultant, after review of the USDOE data, concluded that there is a significant likelihood that the site will fail this test. It appears the cost of making shafts and underground workings safe in fractured basalt will be extremely high. These and other serious technical concerns are discussed in some detail in the materials which we provided to each member of the Subcommittee.

In 1986, 83% of the state's voters directed state officials to continue to take all possible steps to halt USDOE's unlawful implementation of the site selection process. The state of Washington has filed five lawsuits in the Ninth Circuit Court of Appeals, challenging USDOE's actions. We believe our lawsuits have an excellent chance of succeeding. As with a recent decision by the First Circuit Court of Appeals, which struck down EPA's standards for a repository, thus calling into serious question the repository siting guidelines and the environmental assessments for all five candidate sites, these suits are likely to cause further delays.

We have an opportunity now to avoid the delays, save very large sums of money, and raise the likelihood of opening a high quality repository, by establishing a moratorium and solving the problems before they do even more damage.

FOCUSPAPER

Washington State Nuclear Waste Board
Nuclear Waste Advisory Council

Site Characterization

Key Issues for Washington State

FOCUSPAPER

Washington State Nuclear Waste Board
Nuclear Waste Advisory Council

SITE CHARACTERIZATION:

KEY ISSUES FOR WASHINGTON STATE

OFFICE OF NUCLEAR WASTE MANAGEMENT
WASHINGTON DEPARTMENT OF ECOLOGY

JULY 1987

ABSTRACT

The Washington State Nuclear Waste Board and Advisory Council have identified several key technical and programmatic issues which must be resolved as Hanford is characterized for a high level radioactive waste repository. The Office of Nuclear Waste Management has prepared a focus paper which discusses these issues, recommends actions the U.S. Department of Energy can take to resolve them, and describes how citizens can become involved. Particular technical concerns raised in the focus paper include: groundwater travel time, regional geologic features, miner safety, earthquake swarms, presence of natural resources, radionuclide and chemical contamination, retrievability, program and data management, and overall site characterization approach. An additional concern raised is the need for a longer review period for the 9,500 page Site Characterization Plan.

INTRODUCTION

On May 28, 1986, the President approved the U.S. Department of Energy's recommendation of Hanford in southeastern Washington state as one of three candidate sites for a repository for the nation's high-level nuclear waste. For more than 40 years, Hanford has been used for nuclear activities by the federal government. The site was originally developed as part of the Manhattan Project to produce plutonium for weapons used in World War II. Plutonium production has continued at Hanford to the present day.

The Nuclear Waste Policy Act (NWPA) of 1982 set out a process and schedule to identify two deep geologic repositories for high-level nuclear waste. To determine whether or not Hanford can meet the requirements for deep geologic isolation of highly radioactive wastes for an extended period of time into the future, the U.S. Department of Energy (USDOE) has embarked on a five to six year, $1.2 billion study program at Hanford. Under the NWPA, this program of studies, referred to as "site characterization", must be described in a Site Characterization Plan (SCP). The NWPA requires USDOE to provide the SCP for review by the U.S. Nuclear Regulatory Commission (USNRC), the affected states and tribes, and the public before beginning to drill the exploratory shafts necessary for site characterization.

The SCP for Hanford (a 9,500 page document that cites 1,865 references) outlines and provides the rationale for the site characterization program, details the information required, and explains how data will be obtained to determine the suitability of the Hanford site. In addition, the SCP provides a detailed schedule and quality assurance plans.

The state of Washington has been closely tracking the repository site selection process and will continue to do so during site characterization. Reviewers have identified a number of technical issues and concerns related to the capabilities of the Hanford site to meet the isolation requirements for a high-level nuclear waste repository. The state also has numerous procedural concerns about the way in which USDOE conducted its selection process. It has several lawsuits pending in federal court to halt the siting process and to require USDOE to follow the procedures set forth in the NWPA. Washington state will continue to insist that USDOE's plans must respond to these issues and concerns.

The purpose of this focus paper is to provide citizens with an overview of the state's issues related to site characterization. This is part of the goal of the state's public information and involvement program. The Washington State Nuclear Waste Board and Nuclear Waste Advisory Council will sponsor public information meetings about the SCP and the related issues, and provide an opportunity for citizens to express their views to state officials. Public comments and concerns will be considered in the state's review of the SCP. Citizens are also encouraged to participate in public meetings and the review process sponsored by USDOE.

In order to place the issues in perspective, this paper will explain:

- Why a repository is needed
- How Hanford was selected for site characterization

and describe:

- The USDOE approach and schedule

- The state of Washington's technical program and policy issues
- Specific opportunities for public involvement

Particular technical concerns identified by Washington State and described in the report include:

- Groundwater travel time
- Regional geologic features
- Mining conditions in deep basalt
- Earthquakes
- Presence of natural resources
- Radionuclide and chemical contamination
- Retrievability of wastes
- Program and data management
- Overall site characterization approach

BACKGROUND

Since the late 1950's, nuclear wastes in the form of spent nuclear fuel rods have been accumulating in temporary storage pools at commercial nuclear reactor sites throughout the country. Presently, spent fuel assemblies containing more than 12,000 metric tons of uranium are stored at 93 commercial nuclear power plants. These plants are adding about 2,000 tons each year. By the year 2000, the total amount of spent fuel is expected to reach nearly 40,000 tons.

These spent fuel rods are considered "high-level" wastes because they contain radioactive elements in such high concentrations that they must be handled remotely. Water circulating in storage ponds cools the fuel rods and blocks the intense radiation. All of the radioactive elements will decay to harmless levels eventually, but for some, the decay is so slow that they will remain dangerous for hundreds of thousands of years. Forty years of defense-related operations at Hanford have also generated large quantities of high-level nuclear wastes now temporarily stored on the site.

By the late 1950's, with the growth of the commercial nuclear power industry and the Cold War nuclear weapons buildup, it became clear that short-term solutions to nuclear waste disposal must give way to disposal methods which would provide long-term isolation from the environment. In a 1957 report to the Atomic Energy Commission, the National Academy of Sciences recommended disposal of nuclear wastes in stable geologic (rock) formations.

What Would a Repository at Hanford Look Like?

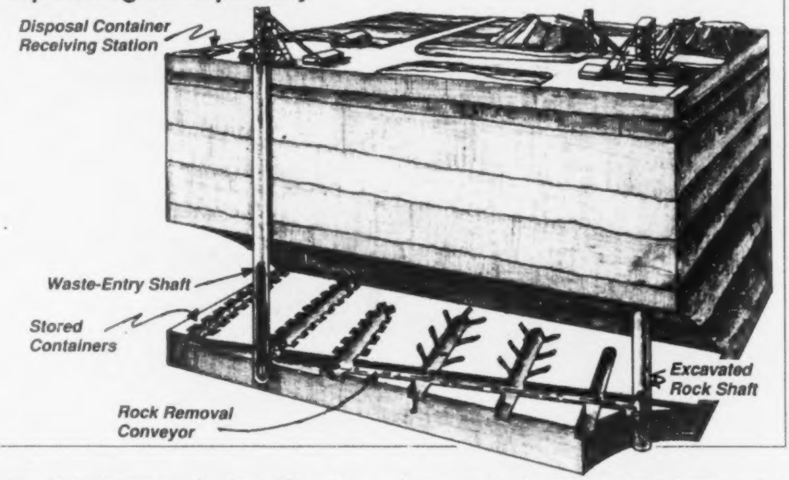
The search for stable rock formations in the continental United States has included the basalts under Hanford. A geologic repository would look much like a large mining operation. Surface facilities to handle the nuclear waste would occupy about 400 acres. About five separate shafts would be constructed to depths of 3,200 feet for personnel and equipment, wastes, and ventilation. Tunnels in which the wastes would be buried would extend horizontally from the bottom of the shafts to occupy an area of roughly two square miles. The repository would be in operation for about 25 to 30 years. At least 50 years after the first wastes are buried, the repository would be closed and sealed. The period of operation during active transportation and burial of wastes is termed the "preclosure period." The final closure and sealing of the wastes would mark the beginning of what is termed the "postclosure period," a planning period in excess of 100,000 years.

An important part of the repository would be the "engineered barriers." These would include the metal canister that contains the spent fuel rods, a second metal burial container, and a crushed rock and clay mixture that would fill the space between the metal waste container and the surrounding rock wall. This container and mineral combination is called the "waste package." This package must meet U.S. Environmental Protection Agency (USEPA) and U.S. Nuclear Regulatory Commission (USNRC) requirements that the waste package provide complete containment for a minimum of 300 years. The final engineered barrier would be the repository seals, which would involve backfilling and sealing the shafts and tunnels.

How Was Hanford Selected for Site Characterization?

The Nuclear Waste Policy Act (NWPA) passed by Congress in 1982 directs USDOE to select sites for two permanent high-level nuclear waste reposi-

Conceptual Rendering of a Deep Geological Repository



tories in the United States. In April 1983, the USDOE identified nine potentially acceptable sites for permanent disposal in stable geologic formations. Draft Environmental Assessments (EAs) for the nine sites were prepared and issued in December 1984 by USDOE. The Secretary of Energy nominated five of the nine sites as suitable for site characterization.

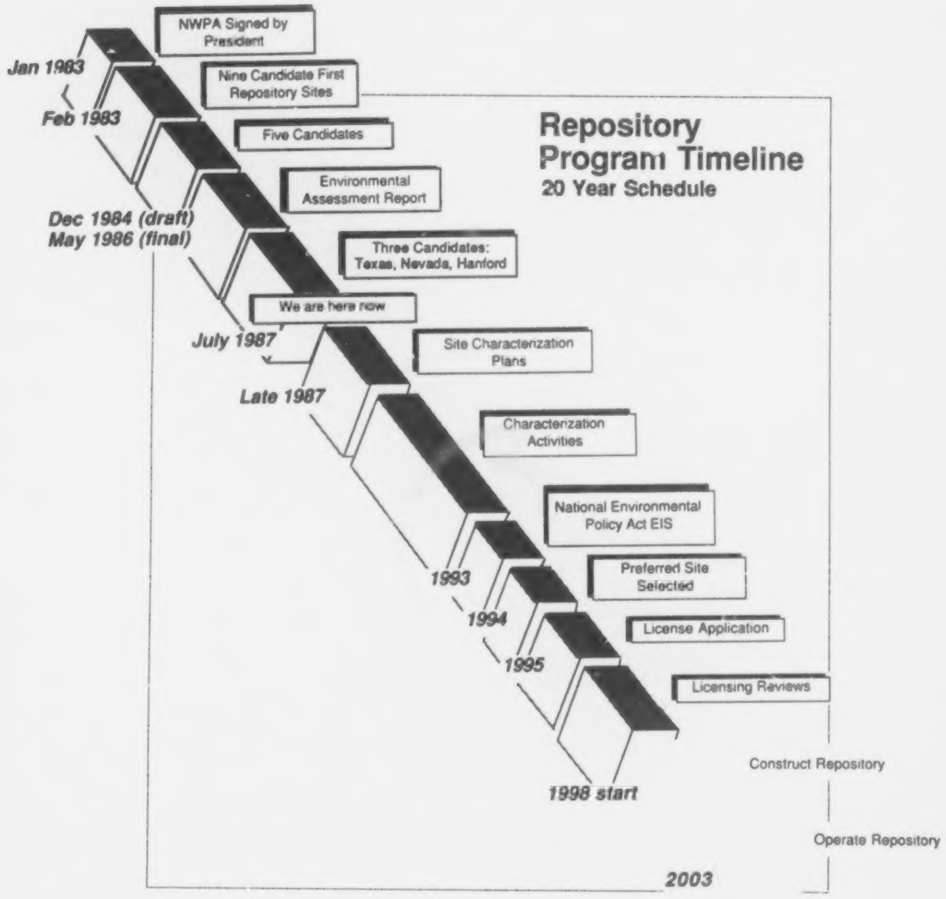
A decision-aiding methodology was developed by USDOE to assist in determining the preferred ranking of the five nominated sites. The ranking methodology involved evaluations of a number of preclosure and postclosure siting objectives. Four major performance objectives were identified for preclosure: (1) minimize adverse impacts on health and safety before closure, (2) minimize adverse environmental impacts, (3) minimize adverse socioeconomic impacts, and (4) minimize economic costs.

Overall, the Hanford site ranked as least suitable in these preclosure objectives. The Yucca Mountain site in Nevada ranked most suitable. On individual objectives, Hanford was the least suitable site based on health and safety impacts and economic costs and the most suitable based on environmental and socioeconomic impacts. According to USDOE, if economic costs are not considered, Hanford ranks as the most suitable overall site in the preclosure period followed by Yucca Mountain.

USDOE identified two postclosure objectives related to the isolation of the high-level wastes from the accessible environment: (1) minimize adverse health effects attributable to the repository during the first 10,000 years after closure, and (2) minimize adverse health effects attributable to the repository during the period 10,000 to 100,000 years after closure.

Hanford ranked last on postclosure and overall, being the least safe and most expensive of the five sites. For both time periods, the Hanford site would produce significantly greater cumulative releases of radioactive elements to the accessible environment than other sites. However, USDOE estimated these releases to be much lower than the EPA limits and judged that there was little practical advantage of one site over another site with respect to postclosure performance.

On May 27, 1986, the Secretary of USDOE


Repository
Program Timeline
20 Year Schedule
NWPA Signed by President
Jan 1983
Nine Candidate First Repository Sites
Feb 1983
Five Candidates
Environmental Assessment Report
Dec 1984 (draft)
May 1986 (final)
Three Candidates: Texas, Nevada, Hanford
We are here now
July 1987
Site Characterization Plans
Late 1987
Characterization Activities
National Environmental Policy Act EIS
1993
Preferred Site Selected
1994
License Application
1995
Licensing Reviews
Construct Repository
1998 start
Operate Repository
2003

issued the final EAs on the five sites, and recommended three sites to the President as suitable for site characterization: the Yucca Mountain site in Nevada, the Deaf Smith site in Texas, and the Hanford site in Washington. The following day, May 28, 1986, President Reagan approved the recommendation. The President's approval formally initiated the characterization of the Hanford site as a candidate for the nation's first nuclear waste repository. In the Secretary's report documenting the recommendation, maximum diversity of geologic setting and rock type were stressed as major factors in the final decision. Other factors which influenced the recommendation of the Hanford site included federal ownership of the land and its control by USDOE.

What Is Site Characterization?

The NWPA defines site characterization as "activities whether in the laboratory or in the field, undertaken to establish the geologic condition and the ranges of parameters of a candidate site..., needed to evaluate the suitability of a candidate site for the location of a repository." Site characterization consists of laboratory tests, tests conducted using drilled boreholes, geologic studies which can be conducted at the surface, such as geologic mapping and seismic surveys, and studies in the host rock at the proposed depth of the repository. The information gathered as a result of these activities will be used by USDOE in recommending one of the three candidate sites as the nation's first nuclear waste repository.

Major site characterization studies at the Hanford site under the Basalt Waste Isolation Project (BWIP) began in 1978 with the construction of the Near Surface Test Facility. By 1982, a site on the Hanford Reservation was selected as the Reference Repository Location (RRL) and a Site Characterization Report was issued. Later, a large drill rig was brought on site to drill the first exploratory shaft. Because the NWPA requires USDOE to submit a Site Characterization Plan (SCP) and make it available to the public, affected states and Indian tribes before proceeding to drill major exploratory shafts, USDOE has been limited to surface-based investigations since 1983.

SITE CHARACTERIZATION PLAN AND ACTIVITIES

USDOE expects to have the SCP for Hanford available by late 1987. When the SCP is released, there will be a 90-day comment period on sections related to the exploratory shaft drilling. The site characterization program is expected to narrow the range of uncertainties, eliminate alternative interpretations, and confirm or revise assumptions made in the final environmental assessment (EA) used in selecting Hanford as a candidate site. Similar studies will be undertaken at the Deaf Smith site in Texas and the Yucca Mountain site in Nevada. An environmental impact statement will compare sites after characterization is completed.

The SCP is divided into two principal parts. The first part describes the Hanford site, the waste package, and the repository. It will present existing information pertaining to the geology, geoengineering, hydrology, geochemistry, climatology, and meteorology of the site. The second part will be the major portion of the SCP and presents the site characterization program. It will present:

- The rationale for the planned site characterization program
- Issues to be resolved and information required during site characterization
- Planned tests, analyses and studies
- Planned site preparation activities
- Milestones, schedules, and decision points
- Quality assurance plans
- The decontamination and decommissioning activities related to the repository

Although not expressly stated in USDOE's outline, the NWPA requires the SCP to include plans for:

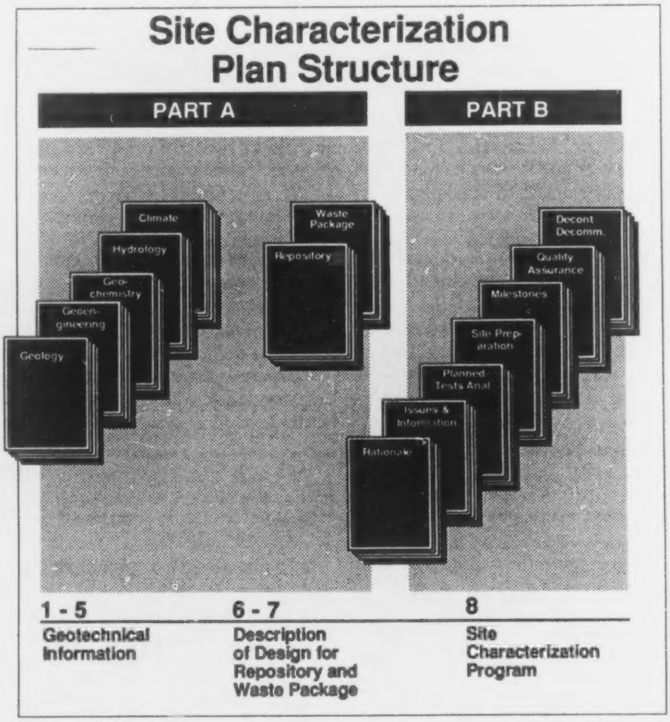
- On-site testing with radioactive or nonradioactive materials
- Activities that may affect capability of the site to isolate the nuclear waste
- Control of safety related impacts for site characterization activities
- Criteria to be used to determine the suitability of the Hanford site as the location of the repository

- The mitigation of any significant adverse environmental impacts caused by site characterization if the site is determined to be unsuitable as a repository

During site characterization, the NWPA requires USDOE to report at least every six months to the USNRC, the governor , the legislature, and the affected Indian tribes on the nature and extent of site characterization. Governor Gardner requested information from USDOE about ongoing and planned activities in October, 1986. USDOE's response outlining ongoing and planned activities included:

Hydrology. Program activities include the development of a conceptual model of the groundwater system beneath the Hanford site to determine the direction and rate of groundwater flow. Boreholes are being monitored to determine hydrologic parameters.

Geology. These activities support development of the stratigraphic and tectonic models of the Hanford site. These include seismic surveillance and data collection to determine the stability and structure of the site, and boreholes to determine the rock structure. Important structures would include faults and fractures in the rock.



Site Characterization Plan Structure

PART A
PART B
Climate
Hydrology
Geo-chemistry
Geoen-gineering
Geology
Waste Package
Repository
Decont Decomm.
Quality Assurance
Milestones
Site Prep-aration
Planned Tests Anal
Issues & Information
Rationale
1 - 5
Geotechnical Information
6 - 7
Description of Design for Repository and Waste Package
8
Site Characterization Program

Geochemistry. This program covers three main areas. Site geochemistry concentrates on characterization of groundwater chemistry and the transport of radioactive elements in the groundwater between the repository and the accessible environment. Rock geochemistry evaluates the types and chemical stability of mineral phases in the RRL. Engineered barriers geochemistry supports the development of geochemical models of the waste package and performance assessment of the waste package.

Geomechanics. This program measures engineering parameters which describe the mechanical, thermal, and thermomechanical behavior of the host rock at the Hanford site. Geomechanical studies will determine the amount and type of stress the deep rock formations are under at the Hanford site. This is important since drilling the large shafts and tunnels may release internal rock stress destroying the structural integrity of the rock. Thermal studies are important because at the proposed repository depth, natural geothermal temperatures are over 120 degrees Fahrenheit. The waste containers would also generate heat, which would add to the thermal stress in the host rock.

Waste package. The studies will test the performance of materials, design a waste package, and predict its long-term performance. The studies will include the effects of radiation on the waste package-groundwater-basalt isolation system to determine the durability of materials exposed to long-term radiation, and the transport and release of radioactive elements from the waste package.

Repository seals. These studies will assist in the design and development of the postclosure repository seals which must meet the USNRC and USEPA standards for waste isolation. These studies include water movement through the seals at various temperatures and mechanical properties of the material used for the seals.

A key part of the site characterization program at Hanford would be the construction of the Exploratory Shaft Test Facility (ESTF). This would allow testing of the host rock at the depth of the repository (approximately 3,200 feet). One of the largest drilling rigs in the world would drill two exploratory shafts. The shafts would be lined with watertight steel casing that would be sealed in place with a cement grout. Once at depth, rooms and tunnels would be constructed to conduct tests on the host rock. Plans call for underground tunnels to be as much as 3,400 feet long. The drilling of the shafts and construction of the test facility would take about five years. However, drilling at Hanford cannot begin until public hearings are held on the SCP and USDOE has consulted with the state, affected tribes, and USNRC.

KEY ISSUES AND CONCERNS FOR WASHINGTON STATE

Both the state and USNRC, in their reviews of the final EA for the Hanford site, considered the evaluations and conclusions regarding site conditions made by USDOE to be overly optimistic. These concerns will have to be addressed in the site characterization studies. These concerns are summarized below.

Groundwater Travel Time

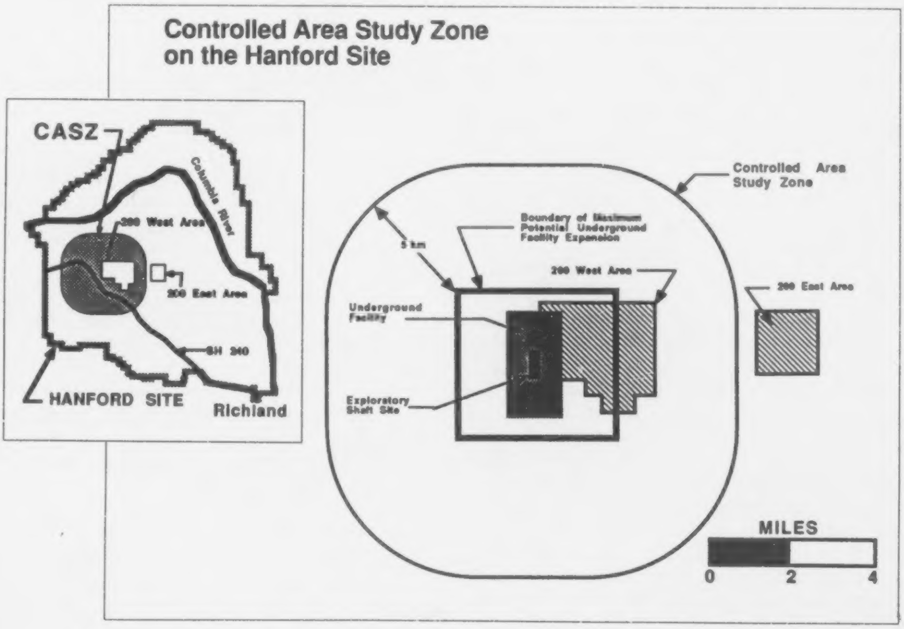
Groundwater investigations are critical to determining the performance of the Hanford site as a repository because, after repository closure, groundwater is the primary route for radionuclides to reach the human environment. These investigations are especially critical to the Hanford site because it is the only saturated (wet) site under consideration, groundwater travel times quoted in earlier USDOE reports have been over-optimistic, and many experts believe USDOE may have seriously misinterpreted Hanford geology and hydrology.

A case in point is a disagreement over how much confidence scientists can place in calculations made before pre-exploratory shaft studies are completed. USDOE believes current information on geohydrologic conditions suggests, with high probability, that groundwater travel times will exceed 1,000 years (USNRC's minimum requirement). The state of Washington and a USNRC consultant believe that calculations using current USDOE hydrologic data and a range of values for effective porosity will indicate that Hanford groundwater travel times will be faster than USNRC permits. The state's position is that a "fatal flaw warning flag" is already flying and the USDOE testing program must be designed accordingly.

Groundwater investigations are the most critical element of the site characterization program for Hanford. Critical portions of the investigations must precede the drilling of exploratory shafts which will disturb the deep groundwater system and destroy valuable "perishable" data. The pre-exploratory shaft groundwater investigations must be completed and reviewed before start-up of the exploratory shaft drill rig. Start-up of the drill rig may require postponement if pre-exploratory shaft studies do not reduce the current range of uncertainties associated with Hanford groundwater travel time calculations.

The state of Washington's review of the hydrology portion of USDOE's SCP will focus on pre-exploratory shaft testing. Such testing should provide the following:

- Appropriate data to determine if the range of uncertainties currently associated with groundwater travel times can be reduced. Emphasis should be placed on collection of effective porosity and vertical conductivity data
- Adequate data to explain subsurface geologic irregularities (anomalies), such as the so-called Cold Creek flow impediment
- Information to determine if USDOE's conceptual model adequately explains Hanford's complicated fracture flow groundwater system
- Information to determine source and concentrations of methane and radionuclides in groundwater



Controlled Area Study Zone on the Hanford Site

CASZ
Columbia River
200 West Area
200 East Area
SH 240
HANFORD SITE
Richland
Controlled Area Study Zone
Boundary of Maximum Potential Underground Facility Expansion
5 km
200 West Area
200 East Area
Underground Facility
Exploratory Shaft Site
MILES
0
2
4

Regional Geologic Features

Surveys used to support USNRC licensing of a nuclear power plant on the Hanford Reservation, together with data from other sources, identify a bounding fault pattern in the vicinity of the proposed Hanford repository. This information should be used to locate high priority target areas where deep faults may provide a pathway for groundwater movement. Plans for site characterization should include specific plans to drill in the priority area specifically for the purpose of finding faults and other "fatal flaws" with the potential for site disqualification. Early drilling is also needed in the vicinity of geologic anomalies such as the Cold Creek flow impediment in order to provide critical information about these geologic features.

Miner Safety

The deep Hanford basalt flows are under great stress from natural forces, and these forces are unequal. When confining forces are removed, as would happen if construction begins, the strong but brittle rock often fractures spontaneously. Such fractures could provide a pathway for radionuclides to reach the accessible environment. Therefore, the in situ (in-place) stress level is a critical element in site characterization activities. Slight in situ stress increases mean that waste packages must be spaced further apart, resulting in increased cost. Rockbursts, which are associated with high in situ stresses, can cause worker injuries and fatalities.

USDOE is proposing a very deep and large mine which would be both dangerous and debilitating to workers. The natural rock has a temperature of 120 degrees Fahrenheit. Temperatures in work areas would increase with waste emplacement. In comparison with other proposed repository sites or commercial mines, massive ventilation and rock stabilization efforts must be undertaken. Hanford mining conditions would be inherently more dangerous than other underground mining operations. Even though actual work hours would be constrained, miners under constant physical stress are prone to errors in judgment. Adverse working conditions and the resulting constrained working hours would add to the costs for the BWIP project. USDOE's early SCP studies should be oriented toward finding out if the risks to Hanford workers and the environment are reasonable.

Methane is especially dangerous at depth because it poses threats of asphyxiation and/or explosion if not continuously removed. USDOE recently concluded that "gassy mine" conditions would exist at depth. This means that USDOE must factor this condition into the design basis for ventilating the exploratory shaft and underground workings.

The state of Washington review of those portions of the SCP relating to mining and geology will focus on the following:

- Ensure that USDOE collects adequate information concerning the full range of in situ stress values in the controlled area study zone (CASZ)
- Gain a better understanding of the possible effects (fracturing, rockbursts, rock sloughing) of mining in deep basalts
- Gather information derived early in site characterization which could be used to assess the stability of unlined shafts or work areas
- Develop descriptions of special equipment or procedures needed to protect workers from rockbursts, high water pressures and methane
- Evaluate areas within the CASZ with lower in situ stresses that might provide safer rock for exploration
- USDOE descriptions of how methane concentrations in air will be maintained at safe levels in both the ventilated and unventilated portions of the proposed underground workings
- USDOE provisions to ensure adequate safety in case of a loss of power and/or ventilation

Earthquakes

Compared to areas west of the Cascades, large earthquakes pose a minor risk to a Hanford repository. However, many small earthquake swarms may occur in a specific area with no large single event. Events of this type are indicative of stress release. The distribution of the swarms gives an indication of where fracturing is occurring in the basalt flows and gives some indication of possible groundwater pathways through the fractures to the environment.

The state of Washington review of the earthquakes (tectonics) portion of the SCP will include:

- Ensure that USDOE data collected during site characterization is accurate enough to detect and precisely locate all shallow earth quake swarms in and near the Hanford site
- Use data to correlate the swarms with mapped or suspected structures

Presence of Natural Resources

USDOE siting regulations automatically disqualify any site if it is found that previous exploration, mining, or extraction activities of commercial importance have created significant pathways between the underground facility and the accessible environment. These regulations also apply if ongoing or future activities to recover presently valuable mineral resources may be expected to lead to inadvertent loss of waste isolation. USDOE has acknowledged that many companies have requested to lease USDOE land on the Hanford site for exploratory oil and gas drilling. USDOE also acknowledges that Hanford's deep groundwaters contain high concentrations of methane (natural gas). Methane and warm groundwater could attract future exploration activities.

The state of Washington SCP review will focus on:

- An independent, state-of-the-art seismic survey to investigate the potential for geologic structures conducive to natural gas accumulation. The survey would also yield information concerning suspected faulting in or near the CASZ. Field work for the survey should be completed and the results evaluated by the affected parties before exploratory shaft construction

Radionuclide and Chemical Contamination

The BWIP Controlled Area Study Zone is located in an area of the Hanford Reservation which is already heavily contaminated with chemicals and radionuclides. Site characterization activities should be designed to minimize the spread of contaminants and affected parties must have enough information to do an adequate environmental review of each activity.

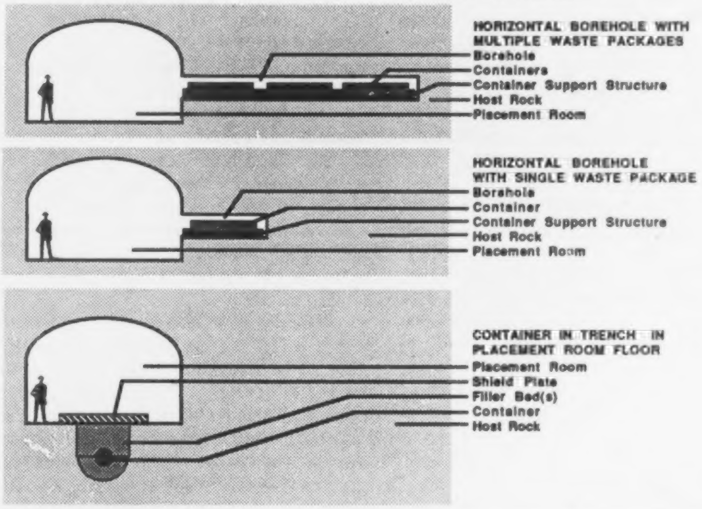
Recently USDOE has released historic documents which strongly indicate that contamination from early defense activities may have already spread to both shallow and deep groundwaters, both on and off the reservation. If this is true, this may be another reason for early disqualification of the site. The fast migration of radionuclides to deep groundwater (40 years) would suggest a relatively direct connection between deeper groundwater and the environment. It would also suggest that large water discharges from current Hanford defense activities may affect how quickly contamination moves downward. At a very early stage of site characterization, USDOE must provide maps and documents which clearly identify the locations and quantities of contaminants within the CASZ. Non-USDOE experts should conduct an independent evaluation on how defense wastes have reached deep groundwaters on and off the reservation.

Retrievability

The Nuclear Waste Policy Act requires that high-level nuclear waste packages must be retrievable after emplacement. Retrieval of the packages could be necessary for recovery of increasingly valuable materials, or in the event of a repository failure. USDOE has recognized that retrieving waste packages from Hanford's deep basalts will be difficult. The high in situ stresses may cause rockbursts and rock sloughing, which could lock canisters in boreholes. At each stage of the

EVOLUTION OF CONCEPTS BY USDOE FOR RETRIEVABILITY OF NUCLEAR WASTE PACKAGES

EACH SUCCEEDING APPROACH HAS INCREASED COSTS WHILE NOT PROVIDING CONFIDENCE THAT THE CANISTERS CAN BE RETRIEVED


HORIZONTAL BOREHOLE WITH MULTIPLE WASTE PACKAGES
Borehole
Containers
Container Support Structure
Host Rock
Placement Room
HORIZONTAL BOREHOLE WITH SINGLE WASTE PACKAGE
Borehole
Container
Container Support Structure
Host Rock
Placement Room
CONTAINER IN TRENCH IN PLACEMENT ROOM FLOOR
Placement Room
Shield Plate
Filler Bed(s)
Container
Host Rock

program, USDOE has developed an engineering "fix" to remedy newly emerging retrievability problems. At an early stage of the program, the plan was to place multiple canisters in long boreholes. USDOE is now considering a shallow trench approach. Each succeeding approach has significantly increased costs while not providing greater confidence that canisters could be retrieved as required by the NWPA.

If mining conditions are going to be at the limits of tolerability for workers and equipment at the beginning of underground operations, mining experience indicates that later operations would be so difficult, dangerous, and expensive that recovery of thousands of individual waste containers would be practically impossible. If spent fuel is placed in the rock system, enormous amounts of "new" heat will affect the already hot, inherently unstable Hanford geologic environment. In real mines, workings are kept open only for a matter of months, then abandoned to collapse and admit groundwater. There is no underground job more feared than dewatering an old, wet, deep mine. The state of Washington plans to closely review all characterization plans affecting retreivability.

Program and Data Management

USDOE's high-level waste management program has been plagued by serious program and data management problems. The overall USDOE approach has been based on competition among projects which were "grandfathered" into the Act. The following is a direct quote from a USDOE fact sheet titled, "Management Changes in the Geologic Repository Program."

> "The Nuclear Waste Policy Act (NWPA) caused a fundamental change in the character of the Geologic Repository Program. Prior to the NWPA, the Geologic Repository

Program had many of the characteristics of a competition among three distinct projects, where each was managed by a different project office located under a different DOE operations office. The program's strategy was that the repository would be built by the project office that first produced a satisfactory site."

It is important to note that this fast track strategy of selecting an adequate rather than superior site was used to nominate Hanford for characterization. USDOE is now planning to contract for a Systems Engineering Development and Management (SEDM) contractor to manage the overall program. This is probably an improved approach, but the SEDM contract will not be in place for at least two years. Clearly, substantial site characterization should not occur until the new management philosophy is operational.

The national nuclear waste program, in general, has had serious problems in ensuring the quality of data. Specifically, BWIP field work at Hanford was stopped because of very serious quality assurance problems. The SCP and data collected during site characterization must meet the rigid quality requirements required for licensing a repository. Data collected under earlier inadequate quality assurance programs should not be used in repository licensing.

The immense volume of data will soon create other serious problems. The Site Characterization Plan alone will contain approximately 9,500 pages and will reference 1,865 documents. The enormous amounts of data and the many reports resulting from this plan will have to be stored and then be easily retrievable to all interested parties when needed. The fact-finding process for repository licensing could take years if there is not an effective data management system. USDOE and USNRC are now in the beginning stages of developing procedures and hardware required for a multi-million dollar Licensing Support System (LSS). Current estimates indicate that the system will not be in place for two or three years. Substantial site characterization should not occur until an adequate LSS is in place.

Overall Site Characterization Approach

USDOE must abandon its current fast-track approach to select a merely adequate site and develop a new approach that emphasizes:

- The need for a superior site which the public could accept
- An early and continuing search for fatal flaws which might lead to identification of disqualifying conditions. Early identification of such conditions would save hundreds of millions of dollars that could be better spent on superior sites. In addition, program credibility would be enhanced if program decisions are dictated by objective, scientific factors.

Site Characterization Plan Review

USDOE plans to provide 90 days for review of the Site Characterization Plan by affected parties and the public. Concerns have been raised that this time period is too little for technical review of the SCP, which cites 1,865 references and is 9,500 pages long. State reviewers believe that at least six months should be provided for review of the SCP.

PUBLIC INVOLVEMENT

During the Hanford site characterization process, the state of Washington will continue to review results of the site characterization studies and will provide information to citizens of the state about the process and opportunities for Washington citizens to participate in the state's review. The Nuclear Waste Board and Nuclear Waste Advisory Council will hold public meetings on the SCP to provide information and to hear public concerns and comments on the SCP. This input will be considered in the state's responses on the SCP. Information about the state's key site characterization issues will be useful in citizens' input to USDOE's public participation program.

Before a final repository site is recommended to the President, there will be at least two formal opportunities for public comment on the site characterization activities and results. The first comment opportunity will be when the Site Characterization Plan (SCP) is issued. The USDOE must submit the SCP to the USNRC, the governor and the legislature of the state, the affected Indian tribes, and the public for review and comment. When the SCP is released in late 1987, there will be a public comment period, and public hearings will be held by USDOE. The public review period will be at least 90 days for portions of the SCP related to the exploratory shaft, and may be longer for other sections of the SCP. Washington citizens are encouraged to provide comments on the SCP at the public hearings or in writing to USDOE.

The second formal public comment opportunity will be when the Draft Environmental Impact Statement (DEIS) on the site selected by USDOE for the repository is issued. The DEIS will use the site characterization testing results to address the suitability of the selected site for development as a repository. The DEIS review will be the last major point in the formal site selection process in which the general public can be directly involved. It is scheduled for release in the last quarter of 1993. Washington citizens will have an opportunity to make comments on the DEIS at public hearings and/or in writing.

Referendum 40, approved by state voters in 1986, may provide an additional opportunity for public comment if Hanford were selected by USDOE. The citizens of the state of Washington would have an opportunity to register a vote of disapproval unless the Governor or legislature disapproved the site selection first. A majority vote of both houses of the U.S. Congress overriding the disapproval would be required to permit the USDOE to pursue construction of the repository.

OTHER RELEVANT MATERIALS

The Washington Department of Ecology Office of Nuclear Waste Management has a variety of informational materials related to the repository siting process. These materials include slide shows (some available in VHS videotape format), fact sheets, and focus papers. The Office prepares a quarterly newsletter that is mailed to over 14,000 recipients.

Speakers are also available from the Office and meetings and workshops are held periodically throughout the state.

If you would like to receive the newsletter or other information related to nuclear waste management issues in Washington State, contact:

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1-800-262-SITE

STATEMENT
OF
ROBERT R. LOUX
EXECUTIVE DIRECTOR
AGENCY FOR NUCLEAR PROJECTS
STATE OF NEVADA
BEFORE THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
JULY 16, 1987

Chairman Johnston, and Members of the Committee, thank you for the opportunity to present the State of Nevada's views concerning S. 1266, the High-Level Waste Storage Act, introduced by Senator Evans; S. 1007, introduced by Senator Hatfield to amend the Nuclear Waste Policy Act; and three bills introduced by Senator Hecht -- S. 1141, the Nuclear Energy Waste Policy Act of 1987; S. 1211, the Nuclear Waste Reprocessing Study Act of 1987; and S. 1428, the Subseabed Nuclear Waste Disposal Research Act of 1987.

We wish to commend these Senators for their thoughtful and responsible efforts to help resolve a number of the current problems with DOE's hopelessly flawed nuclear waste disposal program. Senator Hecht's and Senator Evans' bills address several major deficiencies in DOE's implementation of the Nuclear Waste Policy Act, including DOE's failure to study adequately alternatives to deep geologic disposal such as reprocessing, long-term storage, subseabed disposal, and a system of regional monitored retrievable storage facilities for long-term waste storage located in proximity to the major generators of high-level waste and spent fuel. Senator Hatfield's bill seeks to clarify the status and participation rights of a State located adjacent to a river or acquifer affected by the siting of a high-level waste repository. Each of these bills addresses different, legitimate and serious concerns with DOE's nuclear waste program.

As you know, Mr. Chairman, we too, along with the other affected States and Indian Tribes, have raised some of these concerns with the program, and many others, in testimony on numerous occasions before this Committee and other Committees of the Congress. In particular, several months ago Governor Bryan urged this Committee to recognize not only the scientific and technical questions that remain regarding the viability and safety of the Nevada site and the suspect methods employed by DOE to collect and analyze site data, but also our fundamental and very legitimate concerns relating to DOE's unfair and defective siting process. DOE's repeated, well documented violations of the Act's legal requirements and its determination to follow its own predispositions have resulted in an unworkable program, totally lacking in public trust, credibility and acceptability.

As we have already testified, we believe that the only way to get DOE's program back on track is to impose a temporary moratorium on any further site-specific work at the three sites selected for characterization, and appoint an independent commission to study what has gone wrong with DOE's implementation of the program and to recommend actions to correct DOE's years of mistakes and mismanagement. We believe that pausing for a brief time now to determine how to most effectively get the program back on track and to keep it there is the best and most responsible approach that can be taken. Such a commission could address the issue of alternatives to deep geologic disposal, such as are raised by these bills, and the status of states, such as Oregon, that are directly affected by the waste program due to their contiguity to bodies of water affected by the siting of a repository. In our view, these issues are most appropriately addressed in the context of a complete review and investigation of all of the current problems with DOE's implementation of the Nuclear Waste Policy Act. Because of the complexity and magnitude of the many deficiencies in DOE's program, we believe that a thorough, careful and unbiased investigation by such a commission is the best way to develop a fair and equitable, technically sound and coherent solution to the nation's nuclear waste problems. We urge this Committee, therefore, to consider these bills in the larger context of a complete review and overhaul of the entire waste program and to report legislation authorizing a temporary moratorium and the appointment of a commission to undertake a careful and objective study of all the problems with DOE's repository program.

Plutonium Recycle: An Unnecessary Threat to International Security

by

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Abstract

The separation of plutonium and its use in fresh fuel in commercial light water reactors, activities which have already begun in Europe and Japan will, if unchecked, by the end of the century, result in an annual flow in routine commerce of tens of thousands of kilograms of separated plutonium. This will require extraordinary security measures to protect the plutonium from theft and sabotage. Commerce in plutonium will eventually spread elsewhere, bringing a score of countries to the threshold of a nuclear weapons capability. The abandonment of the separation and recycle of plutonium giving rise to these risks would pose no economic cost.

David Albright and Harold Feiveson

In 1984, 250 kilograms of plutonium oxide, separated by France from spent fuel from Japanese reactors, was returned to Japan by cargo ship. Out of concern about plutonium "pirates", the ship carried no other cargo but the plutonium; it made no intermediate stops; it was escorted in parts of its journey by French and U.S. warships; and it was continuously tracked through satellite relays by officials in Japan. The Japanese assigned three hundred policemen to guard the plutonium upon its arrival in Japan.[1]

At the end of the century, if current plans by the nuclear industries of Europe and Japan to use plutonium in commercial nuclear power reactors go forward, the annual traffic in separated plutonium in Europe and Japan will be over 25,000 kilograms. (For comparison, the Nagasaki bomb contained 6 kilograms of plutonium). The extraordinary security measures applied to the French-Japanese shipment, to protect the plutonium from theft by terrorists and gangsters, will have had to be routinized on a scale one hundred times greater.

Furthermore, the commercial use of plutonium at the levels contemplated, will significantly undermine efforts to prevent the diversion of the plutonium to national weapons programs. For, once established in Europe and Japan, the commercial use of plutonium will inevitably spread elsewhere and bring a score of countries to the threshold of a nuclear weapons capability by providing them with massive stockpiles of weapons-usable material.

As we seek to show in this paper, these dangers, inherent in the commercial use of separated plutonium, are completely unnecessary. The commercial separation and recycle of plutonium, which are being pursued so assiduously in Europe and Japan, cannot be justified by any consideration of economics, environmental risk, or resource scarcity.

Commerce and Trade in Plutonium at the End of the Century

A number of countries, including France, Great Britain, The Federal Republic of Germany, Japan, Belgium, Switzerland, Italy, and India, have decided to chemically separate the plutonium and uranium from the highly radioactive fission products contained in the spent fuel discharged in their commercial nuclear power reactors (a procedure called "reprocessing"). Figure 1 shows the projected growth over the next fifteen years in separated plutonium from such commercial reprocessing. If present programs proceed, this separated plutonium, will soon exceed even the vast amount of plutonium in U.S. and Soviet nuclear weapons arsenals -- about 200 metric tons, enough for 50,000 nuclear warheads.[2] [3]

The countries which have decided to reprocess have also initiated efforts to use the plutonium and uranium recovered from reprocessing in fresh reactor fuel in light water reactors (LWRs). Such "plutonium recycle" is in contrast to the "once-through" fuel cycle in use today, in which there is no need for reprocessing and in which weapons-usable material is never isolated.

Although the use of plutonium in mixed uranium-plutonium oxide (MOX) fuel in LWRs has, so far, been mostly for experimental purposes, it is growing in commercial importance. Germany is now recycling a total of approximately 400 kilograms of plutonium per year in several of its LWRs and plans to increase the amount. Likewise, Japan, Belgium, and Switzerland all have recycling programs that are being expanded. Most significantly, the French electric utility, Electricite de France (EDF), has recently adopted a recycling program, which is intended to absorb by the mid-1990s all the surplus plutonium separated from the spent fuel of EDF reactors.[4]

Barring a sharp turnaround in these programs, by the end of the century there will exist in Western Europe and Japan a highly interconnected traffic in both plutonium oxide and mixed oxide fuels. Figures 2, 3, and 4 present a schematic picture of this activity.[5] Four countries -- France, Great Britain, Germany, and Japan -- will together be separating about 28 metric tons of plutonium per year from LWR spent fuel. Much of the plutonium will be separated in domestic facilities. But France and Britain also plan to devote a substantial fraction of their reprocessing capacity to fuel from Germany, Japan, Belgium, Italy, the Netherlands, Spain, and Switzerland. Most of this plutonium, along with the nuclear waste, will eventually be returned to the country of origin. For Germany and Japan, about one-half of their spent fuel will be reprocessed in France and Great Britain.

After reprocessing, the separated plutonium is to be converted to plutonium oxide and then shipped to fuel fabrication facilities in France, Great Britain, Germany, Belgium, and Japan. Almost all of these shipments are to be by truck within continental Europe and by a combination of truck and sea or air in the case of shipments across water. If, on average, each truck shipment contained 100 kilograms of plutonium, approximately 280 shipments of plutonium oxide annually would be required to transport the plutonium to fuel fabrication facilities. If most of the separated plutonium oxide is shipped to the country originating the spent fuel, this transport would include roughly 160 shipments per year intra-country, about 65 shipments per year from French and British reprocessing plants to other European countries, and about 55 shipments per year to harbors or airports where the plutonium will be loaded on ships or planes and sent to Japan. In addition, about 20 shipments by sea would be required each year.[6]

At the fuel fabrication facilities, the plutonium oxide will be blended with uranium oxide and then fabricated into mixed oxide fuel elements and assemblies. Of the 28 metric tons of plutonium entering the fabrication plants, 20 metric tons would be fabricated into approximately 800 MOX fuel assemblies for LWRs, each assembly containing 25 kilograms of plutonium and one-half metric ton of uranium. These 800 assemblies would be sent to about 50 1-GWe reactors using MOX fuel in one-third of their cores. Most of these reactors would be located in France, Germany, and Japan. If, on average, each shipment of MOX fuel contained two assemblies, about 400 shipments of MOX fuel per year to the 50 reactors would be required.[7]

The remaining 8 metric tons of separated plutonium entering the fabrication plants would be fabricated into fuel elements for breeder reactors and two Japanese heavy water reactors at nine separate sites in Britain, France, Germany, Japan, and Italy. The delivery of these fuel elements to the reactors would require on the order of an additional one hundred shipments per year.

In addition to the main theatre of reprocessing and recycling in Europe and Japan, at least three or four other small, albeit ominous (in terms of their proliferation implications) reprocessing efforts would be underway in India, Pakistan, Argentina (and possibly Brazil). By the late 1990s, India could have acquired a stockpile of a few thousand kilograms of separated plutonium; and Pakistan, Argentina, and Brazil (if its reprocessing efforts go forward) could by that time each have stockpiles of a few hundred kilograms. Other countries with substantial nuclear power programs -- such as Korea and Taiwan -- might also seek to acquire reprocessing technology or to buy MOX fuel on an international market.[8]

Implications for Nuclear Proliferation

How well can this array of activities and these quantities of plutonium be safeguarded to assure that they are not diverted to weapons uses -- either by gangster and terrorist groups or by nations?

Terrorist Groups and Physical Security

Nuclear weapons designers have repeatedly stated that reactor-grade plutonium could be used directly in nuclear explosives. Although plutonium from commercial power reactors has a relatively high fraction of the isotope plutonium-240 and is therefore less desireable for weapons than the plutonium produced in dedicated military reactors, the critical mass of reactor-grade plutonium with a thick uranium reflector would still be less than 10 kilograms -- appallingly low compared to the quantities of plutonium soon expected to be in routine commerce.[9]

Plutonium oxide powder, the most common form of plutonium that leaves civilian reprocessing plants or that could be retrieved from mixed-oxide fuels, could be used directly in nuclear explosives without the oxide being converted into a metal. The amount of material required, however, would be considerably larger -- tens of kilograms or more -- than if plutonium metal were used. Alternatively, the oxide could be converted to metal, but this would not be an easy task for inexperienced personnel. Nevertheless, once a terrorist group appropriated a substantial quantity of plutonium oxide, relatively uncontaminated by fission products, it could over time convert the material to weapons or at least plausibly threaten to do so.[10]

Therefore, for purposes of physical protection of the material from diversion to weapons, separated plutonium and fresh MOX fuel will have to be treated as virtually equivalent to weapons-grade plutonium. Given the scope of the commerce in separated plutonium outlined above and the several points of possible diversion -- the reprocessing plant, the plutonium fuel fabrication facilities, the reactors using the recycled plutonium, and the manifold transit routes required -- it is clear that extraordinarily stringent systems of physical protection would be required everywhere.

National Proliferation

The cover of a civilian nuclear power program offers an approach to nuclear weapons acquisition by countries which is inherently less risky and costly than alternative routes. With plutonium recycle technologies, virtually any country engaged in plutonium recycle would have available potentially huge quantities of readily-accessible fissile material. If the country had produced all the components of nuclear weapons other than the fissile material cores, the length of time between a decision to acquire nuclear weapons and its achievement on a potentially very large scale will have shrunk from years to weeks. This process of "latent proliferation"[11] would make it easier for governments first to hide a nuclear weapons program within an ambitious civilian program and then eventually to move rapidly toward an overt weapons program before domestic or international pressures could be mobilized to stop them.

The use of a civilian program to mask a weapons initiative has been dramatically illustrated by recent disclosures about the Swedish nuclear program from 1945 to roughly 1968. During that period, a small group of government officials undertook, in secret, to develop the Swedish civilian nuclear program so that it could quickly be adapted to the manufacture of nuclear weapons. Significant parts of the civilian program were designed specifically to be able to support such a conversion.[12]

This potential for conversion can never be eradicated completely whatever the specific civilian nuclear technologies used. But it can be minimized if nuclear power programs were limited to technologies associated with the present generation of once-through fuel cycles. In this case, the acquisition of nuclear weapons would require the construction of facilities specifically dedicated to the production of weapons-usable fissile materials. These facilities -- reprocessing plants and uranium enrichment plants designed to produce weapon-grade material on a significant scale -- require a substantial and lengthy construction period and they cannot be readily hidden. Their construction is likely to give unambiguous intelligence that a country is embarking on a nuclear weapons program.

Although reprocessing and recycle are now concentrated mostly in countries which either already have nuclear weapons or have signed the Non-Proliferation Treaty and have accepted international safeguards, countries with less advanced nuclear programs will eventually insist on acquiring the advanced nuclear systems. It is pure wishful thinking and arrogant for the Europeans and Japanese to think that only they can be entrusted with or can use effectively sensitive nuclear technologies. Without explicit and nearly universal constraints on these technologies, it will simply be a matter of time before a large number of other countries gain access to enormous quantities of weapons-usable material and to reprocessing and fabrication facilities able to produce such material relatively quickly.

An Unnecessary Risk

Interest in reprocessing derives from at least two beliefs. One is that reprocessing is essential to efficient radioactive waste disposal. For several countries -- including Japan and Germany -- where waste disposal has been a contentious and difficult domestic issue, the willingness of France and Great Britain to reprocess foreign spent fuel offered a politically attractive way to postpone the waste disposal problem.

However, the waste-disposal rationale for reprocessing has lost force. Three countries with major nuclear programs -- the United States, Canada, and Sweden -- have decided to place their spent fuel in long term storage without reprocessing.[13] And several recent studies have confirmed that final disposal of unreprocessed spent fuel would not represent a significantly greater environmental hazard or be more expensive than disposal of high level wastes from reprocessing. This is all the more true if the costs of disposing of the voluminous low-level and intermediate-level contaminated wastes from reprocessing are considered.[14,15]

A second belief that has driven reprocessing remains strong, however. It is that it is essential to capture the energy content of the plutonium contained in the spent fuel by separating it and then recycling it in power reactors. The options for doing so are to use the separated plutonium as startup fuel for breeder reactors or to undertake plutonium recycling in LWRs.

The Breeder Option

Until recently, the nuclear industries in the industrialized countries expected that the plutonium recovered during reprocessing would be predominantly used for the initial loadings of prototype and commercial plutonium breeder reactors. By converting the abundant and fertile isotope, U-238, into chain-reacting plutonium, these reactors would eventually be able to increase the fission energy obtainable from a unit of natural uranium a hundred-fold relative to what is achieved in today's system of power reactors. As long as projections of nuclear power growth remained high and low-cost uranium resources seemed scarce, the development and deployment of breeder reactors and the reprocessing plants necessary to serve them appeared both inevitable and urgent.

The expectations on which the breeder programs were founded have changed markedly over the past ten years, however. Due to greatly reduced growth rates in electricity demand and to heightened concerns about the safety, environmental impacts, and costs of nuclear power, there has been a sharp deceleration in nuclear power programs in much of the world. Also uranium resources are larger than originally expected. The Organization for Economic Cooperation and Development (OECD) now estimates that there are 4 million metric tons of uranium potentially available in nonCommunist countries at recovery costs less than $130/kg-U ($50/lb U3O8) in the highest confidence categories of assured reserves and estimated additional resources and that there are another 9.5 to 12 million metric tons in the category of speculative resources.[16]

As a result of these revised expectations, the timetable for the consumption of the high grade uranium resources has been pushed far into the future. For illustration, if nonCommunist nuclear capacity grew indefinitely at 2 percent per year (roughly the rate now predicted by the OECD to the end of the century) the 4 million metric tons of high confidence resources alone would be sufficient to cover uranium requirements for the nonCommunist countries for 75 years -- even if nuclear power remained based on light water reactors on once-through fuel cycles.

Still more strikingly, the price of uranium could go much higher than $130/kg-U before the costs of the once-through fuel cycle would compare unfavorably to those of the breeder fuel cycle. For example, were a breeder reactor to have a capital cost per kilowatt generating capacity 20 percent higher than that of a typical light water reactor in the U.S. today (less of a breeder penalty than is often assumed), the price of uranium would have to reach nearly $700/kg-U -- over eight times the current price of uranium -- before the cost of LWR-generated electricity exceeded that of the breeder. At this price, which would raise the generation costs of LWR-generated electricity by no more than about one-third, many tens of millions of tons of uranium are likely to become available.[17]

As a result of such considerations, there are, at present, only a handful of prototype and demonstration breeder programs and only one commercial-size breeder reactor, the Superphenix 1, built by France with collaboration from five other European nations (Belgium, Germany, Italy, the Netherlands, and Great Britain).

These programs will be able to absorb only a small portion of the plutonium currently planned to be separated. Even in the most optimistic circumstances affecting breeder development, the planned rate of separation of plutonium will continue indefinitely to exceed greatly the demand of the breeder programs worldwide. See Figure 5.[1,18] Unless current reprocessing programs are drastically curtailed, there will be a cumulative surplus of separated plutonium of at least 100,000 kilograms by 1995 and 200,000 kilograms by the year 2000.

Plutonium Recycle

With the commercial viability of the breeder receding into the distant future and stockpiles of separated plutonium growing rapidly, the nuclear industries in Europe and Japan have become interested in using plutonium fuels in current-generation reactors. In principle, the recycle of the uranium and plutonium discharged from a reactor could reduce natural uranium feed requirements for the reactor by about 35 percent, with the recycled uranium and plutonium each responsible for about one half of this savings. Separative work requirements could be reduced by about 20 percent.[19]

However, if as expected, the spent fuel from the reactors using the mixed oxide fuel is not recycled a second time because of the isotopic composition of the recycled plutonium, the total uranium savings of the reactor system taken as a whole would be less than would be possible with repeated recycle -- or between 20-25 percent.[20 21]

The Economics of Recycling

If reprocessing is not deemed essential for waste disposal or for other reasons, its costs must be included in the calculation of the net benefits of recycling. If they are, fuel cycles that use recycled uranium and plutonium compare very unfavorably with a normal once-through fuel cycle. Although recycle would reduce uranium and enrichment costs by about one quarter, the price of uranium would have to more than triple before the savings in uranium costs made up for the extra costs of reprocessing, of plutonium storage, and of MOX fabrication.[22]

Some utilities may regard the reprocessing of spent fuel as essential regardless of how the separated plutonium is to be used; and they, therefore, will treat reprocessing as a sunk cost in considering whether to recycle the plutonium. Even in this case, however, the economic benefits of plutonium recycle are marginal or non-existent. At the current price of uranium, the net value of fissile plutonium as a substitute for U-235 in LWRs, under a range of assumptions, lies between $0 to $15 per gram.[23] Even at the high side of this range, the plutonium "credit" would represent only about 3.5 percent of fuel cycle costs and less than 1 percent of total electricity generation costs.[24] This plutonium credit would be lowered further by the costs of the stringent security arrangements that will be required for the plutonium being recycled. The costs for the security applied to the shipment of 250 kilograms of plutonium from France to Japan in 1984, mentioned earlier, entailing special modification of the freighter carrying the plutonium, the mobilization of U.S. and French warships, and the establishment of unusual communications procedures, would have amounted at least to several dollars per gram of fissile plutonium.

The poor economics of recycle may be grasped intuitively by comparing the costs of producing a gram of plutonium with its U-235 replacement value in an LWR. The base-line estimate for reprocessing cost adopted in the OECD analysis was $750/kg-heavy metal. If this entire cost is attributed to the production of plutonium, it corresponds to a plutonium production cost of about $114 per gram of fissile plutonium, several times the U-235 replacement values quoted above.

Non-Economic Motives -- Energy Independence

Despite the unfavorable economics of reprocessing and thermal recycle, the nuclear industries in Europe and Japan appear determined to push ahead. Their most often-stated reason for doing so is that reprocessing and recycle could contribute significantly to national energy independence. This strongly felt goal in Europe and Japan draws upon the persistent vulnerability of these areas to oil import disruptions and upon resentment of U.S. attempts in the 1970s to influence European and Japanese nonproliferation policies through their dependence on U.S. enriched uranium exports.

However, the boost to energy independence provided by the recycle of plutonium and uranium in thermal-neutron reactors would be very modest. As already mentioned, it could cut uranium requirements by, at most, 20 to 30 percent. Such savings, while welcome, could not free a country concerned about energy independence from a dependence on uranium imports. And, for many countries, thermal recycle would lessen their dependence on foreign uranium at the price of an increased dependence on a steady and assured flow of plutonium separated in foreign reprocessing plants. It would also make them continually dependent on the integrity of international safeguards arrangements to protect the separated plutonium. Finally, countries would find it more cost effective to reduce the consumption of uranium by means other than plutonium recycle, such as through higher burnup of reactor fuel before discharge and more complete recovery of U-235 from natural uranium at enrichment plants.[25]

In any case, uranium costs so little per unit energy-equivalent that it can easily be stockpiled to guard against supply disruptions. If the price of uranium rose steadily at 2 percent per year, a 30 year (lifetime) stockpile of natural uranium held in reserve for a light water reactor, treated as an inventory, would cost less than $9 million per year for a 1 GWe plant. This would be equivalent to about 1.5 mils/kwh. Such long term storage of oil would be impractical, since on an energy-equivalent basis, oil at $15 per barrel costs over 15 times as much as uranium for a conventional nuclear power reactor.[26]

Conclusion

There can be no doubt that reprocessing and recycling on the scale now envisioned would create a challenge of nightmarish proportions for those seeking to prevent diversion of plutonium to weapons. The most straightforward way for the international community to respond to this challenge would be to abandon plans for plutonium recycle and to defer indefinitely commercial reprocessing not required for research and development on fast breeder and advanced thermal reactors.

There is currently no reason for countries to reprocess their spent fuel. Plans to do so appear mostly driven by inertia and political expediency, including the wish of governments to delay decisions on radioactive waste disposal. But the political calculus of these countries may be changing. Domestic opposition to commercial reprocessing, particularly in Great Britain and Germany, has grown steadily in recent years; and it will doubtless be reinforced by the accident at the Chernobyl power reactor. It therefore seems possible that, even the nations now apparently committed to reprocessing, could be persuaded to change their policy.

France and, to a lesser extent, Great Britain, Germany, and Japan would be the ones most affected by such a change, and they might be expected to oppose a reprocessing and recycling deferral, at least initially. In the long run, however, an international movement away from commercial reprocessing might provide a face-saving reason for these countries to retreat from a costly folly.

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5. These Figures are based on data and references given more fully in "World Inventories of Civilian Plutonium", Reference 2. The data are based

essentially on publicly available information about reprocessing facilities in France, Britain, Germany, and Japan, and on information concerning reprocessing contracts.

6. Shipments by sea will probably contain greater amounts of plutonium on average than by truck. The shipment to Japan by France in 1984 contained 250 kilograms of plutonium. See Ref. 1.

7. Anthony V. Nero, A Guidebook to Nuclear Reactors, University of California Press, 1979, pp. 77 -93. Also OECD Fuel Cycle Study, Ref 14, Annex 15. Although actual values would vary somewhat from reactor to reactor, each MOX assembly, the operational unit for handling, refueling, etc., might typically weigh one-half metric ton and contain about 20 to 25 kilograms of plutonium (4 to 5 percent by weight). A reactor using MOX fuel in one-third of its core would require over 16 MOX assemblies annually.

8. Leonard S. Spector, The New Nuclear Nations, (New York: Vintage, 1984), Ref. 1, pp 83-132, 177-212.

9. T.B. Taylor, Annual Review of Nuclear Science, Vol. 25, pp 407-421, 1975; Report to the American Physical Society by the Study Group on the Nuclear Fuel Cycle and Waste Management, Reviews of Modern Physics, 50, 1, Part ii, January 1977; and J. Carson Mark, Theodore Taylor, Eugene Eyster, William Maraman, and Jacob Wechsler, "Can Terrorists Build Nuclear Weapons?", prepared for the International Task Force on Prevention of

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Nuclear Terrorism, Nuclear Control Institute, Washington, D.C., May 24, 1986, pp 4-5.

10. U.S. Department of Energy, Nuclear Proliferation and Civilian Nuclear Power: Report of the NonProliferation Alternative Systems Assessment Program (NASAP), Volume ii, pp 2-18 to 2-21; and J. Carson Mark, Ref. 4, pp 8-16.

11. Harold Feiveson, "Proliferation Resistant Nuclear Fuel Cycles", Annual Review of Energy, 1978, pp. 357-394.

12. Christopher Larsson, "Build a Bomb!", NY Teknik, No. 17, April 1985, pp.55 - 83. Thomas B. Johansson, "Sweden's Abortive Nuclear Weapons Project", Bulletin of the Atomic Scientists, March 1986, pp 31-34.

13. The U.S. policy on the disposition of spent fuel is set out in the 1982 Nuclear Waste Policy Act. Canadian policy is described in D. Mosey, "How Canada Has Controlled the Spent Fuel Storage Problem", Nuclear Engineering International, February 1985, 23-24; and Swedish policy in "Swedish Fuel Cycle Update: Disposing of Spent Fuel Underground", Nuclear Engineering International, December 1985, 212 ff.

14. The Economics of the Nuclear Fuel Cycle, A Report by an Expert Group, (OECD, Nuclear Energy Agency), Paris, 1985, p. 33. Annexes 2, 3, and 10 report on studies by the OECD/NEA Working Group on Spent Fuel Management of the Nuclear Energy Agency of the OECD and by the Swedish Nuclear Supply

Agency, Final Storage of Spent Nuclear Fuel, KBS-3, SKBF/KBS, Stockholm, May 1983.

15. "The Final Report of the Project Group on Alternative Entsorgung", Karlsruhe Nuclear Research Center, KWA 2190/1, 1984. In terms of repository design for final disposal of the spent fuel, spent fuel and high level waste pose broadly similar problems. The fission product contents are essentially identical and the heat outputs per metric ton of original uranium are similar. It is true that spent fuel, unlike reprocessing waste, would contain the plutonium, a toxic and very long-lived component of the radioactive waste. However, because of process losses during the repeated recycle of plutonium before it fissioned, significant amounts of plutonium from reprocessing would go into the radioactive waste in any case. And, a significant fraction of the plutonium would not be fissioned but transmuted by neutron absorption into heavier trans-plutonium isotopes which would end up in the wastes. As a result the waste from a plutonium recycle fuel cycle would be about as radioactive for about as long as that from a once-through fuel cycle. Hartmut Krugman and Frank von Hippel, "Radioactive Waste: The Problem of Plutonium," Science 210, 1980, p. 319.

16. Uranium: Resources, Production, and Demand, OECD Nuclear Energy Agency, December 1983, pp. 12-28.

17. OECD, Ref. 14, p. 15; Alvin M. Weinberg, "Are Breeder Reactors Still

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Necessary?", Science, 9 May 1986, pp 695-696. We adopted the following assumptions:

For the fuel cycle costs for an LWR, F(L), on a once-through cycle:

F(L) in mils/kwh = 4.3 + .03p, where 4.3 equals the non-uranium fuel cycle costs and p equals the price of uranium in dollars per kilogram of uranium (see Ref. 22);

For estimating breeder fuel cycle costs, F(B), we assumed (Weinberg, p. 695) that the non-uranium fuel cycle costs were 1.7 mils/kwh greater than for the LWR and that the uranium contribution to fuel cycle costs was one-third that of the LWR fuel cycle:

F(B) = 6.0 + .01p

The principal reason why the price of uranium is relevant to breeder fuel cycle costs is that the price of plutonium, that is derived from light water reactors and sold as inventory for breeders, will depend on the value of plutonium as an alternative to uranium in light water reactors. This replacement value will depend on the price of uranium. If one takes a fissile plutonium inventory of 7.5 grams per installed kilowatt electric (including out-of-reactor inventory), a replacement value for the plutonium of $.18p per gram (so that at the current uranium price of $83/kg-U, the value of the plutonium is about $15/gram), and a real discount rate of 5 percent per year, the inventory charge for the plutonium levelized over the life of the reactor is approximately 0.01p mils/kwh.

We assumed, finally, a capital cost of $3000 (1984$) per kilowatt generating capacity for an LWR constructed in the U.S. (U.S. Energy Information Administration, "An Analysis of Nuclear Power Plant Construction Costs", DOE/EIA-0485, p. xi), so that a 20 percent increment would be $600. We assumed also a capital charge of 12 percent per year, and a capacity factor of 70 percent. Each $600 per kilowatt of installed capacity would, therefore, contribute an additional 11.7 mils/kwh to the generation costs of electricity. This fact combined with the fuel cycle relationships given above give a breakeven uranium price of $670/kg-U. Even if the plutonium inventory charge were ignored (so that the breeder fuel cycle costs were assumed not to depend on uranium price at all), the breakeven uranium price between the light water reactor and the breeder would remain high -- about $450/kg-U.

Weinberg assumed a higher capital recovery charge and thus derived an even higher breakeven uranium price of $900/kg-U. Weinberg points out, that at this price, uranium could probably be derived economically form sea-water.

See also Dominique Finon, "Fast Breeder Reactors: The End of a Myth?", Energy Policy, December 1982, pp. 305-321.

18. Michel Rapin, "Thermal Reactor Fuel Reprocessing", *Notes D'Information*, Commissariat a L'Energie Atomique, January-February 1985.

19. OECD Fuel Cycle Study, Reference 14, pp. 150, 154-155. The 0.96 metric tons of slightly enriched uranium in one metric ton of the spent fuel could be enriched to produce 0.15 metric tons of 3.1 percent enriched fuel. Because of the presence of non-fissile U-236, the recycled uranium is considered to be only 80% as effective as fresh uranium of similar enrichment.

The non-fissile isotopes of plutonium make the fissile plutonium in thermal recycle about 90 percent as useful as an equal amount of U-235. Therefore, the 6.6 kg of fissile plutonium in 1 metric ton of spent fuel could displace about 6 kg of the U-235 in 1 metric ton of 3.1 percent uranium fuel (containing 31 kg of U-235). This would allow about a 20 percent reduction in uranium feed requirements.

The fissile plutonium content of 1 metric ton of MOX fuel using natural uranium would be about 27 kg, or 2.7 percent. For MOX fuel using depleted uranium, it would be about 3.2 percent.

20. U.S. Nuclear Regulatory Commission, *Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors*, NUREG-0002, Vol IV C-70. After one (four year) cycle through the reactor, the fissile fraction of the plutonium is reduced from

nearly 70 percent to 55 percent and the fraction of the plutonium in plutonium-238, which is an intense alpha-emitter, is increased from 1.9 percent to over 3.4 percent. This is why it is even less economic to recycle the plutonium a second time.

21. OECD Fuel Cycle Study, Reference 14, pp. 77-78. For self-generated recycle, the MOX fuel on average would comprise less than about 20 percent of the total core. However, current designs of light water reactors permit normal operation of the reactor with up to one third of the reactor core loaded with MOX fuel and the remainder of the core normally enriched uranium. Therefore, in equilibrium, the plutonium from two reactors could be used to supply the plutonium for one reactor using MOX fuel. If the plutonium from this reactor is not recycled a second time, the uranium savings of the reactor system as a whole would be only about 2/3 of what would be possible with repeated recycle.

22. Ibid, pp. 15,60. The critical assumptions are: enrichment costs, $130/SWU; uranium-oxide fabrication costs, $190/kg-U; MOX fabrication costs, $760/kg-HM; reprocessing costs including vitrification, $750/kg-HM; disposal costs of reprocessing wastes, $150/kg-HM; spent fuel disposal costs, $350/kg heavy metal. Under these assumptions and those noted in Ref. 19, the fuel cycle costs of a light water reactor on a once-through fuel cycle can be approximated by:

$$C(0) = 4.3 + .03 \times (\text{price of uranium in \$/kg-U}) \text{ mils/kwh;}$$

The fuel cycle costs for a recycling reactor would be:

C(R) = 5.6 + .024 x (price of uranium in \$/kg-U) mils/kwh

At a uranium price of \$83/kg-U, recycling would cost about 1 mil/kwh more than a once-through system. See also the analysis of Robert L. Civiak, "Economics of Plutonium use in Light Water Reactors", Congressional Reference Service, May 31, 1985.

23. Ibid, Annex 15, p.58. The value of the recycled plutonium may be estimated by comparing the cost of producing a uranium fuel element with that of producing a comparable MOX fuel element. At the current price of uranium, one kilogram of 3.1 percent enriched uranium fuel will cost about \$1,260 (\$550 for uranium extraction and conversion, \$520 for separative work, and \$190 for fabrication). A comparable one kilogram of MOX fuel would cost about \$845 (\$85 for uranium and conversion and \$760 for fabrication). On this basis, since one kilogram of MOX fuel utilizing natural uranium will contain 27 g fissile plutonium, the value of the plutonium will be roughly \$15/g fissile plutonium.

Even this negligible sum will be reduced if the separated plutonium is not recycled immediately after separation. If it is not, the combined costs for short term storage of the separated plutonium and for the removal of americium-241, an undesirable decay product of plutonium-241, which would buildup during storage, would add an additional \$15/g fissile plutonium to the costs of recycling. (The OECD fuel cycle study suggests a range between \$1 and \$3 per gram per year for a few years' storage of LWR-derived plutonium and estimates the cost of removing the americium to be about \$6 per gram.) This would reduce the net value of the fissile plutonium to near zero.

24. A plutonium credit of \$15/gram corresponds to a fuel cycle credit of about 0.2 mils/kwh. This would be less than 3 percent of total fuel cycle costs (see Ref.17). It also represents 0.5 to 1 percent of the total electric generation costs given in Projected Costs of Generating Electricity, A Report by an Expert Group, OECD, Nuclear Energy Agency, Paris 1986, p. 33.

25. For example, as the price of enrichment declines as is generally expected, it will worthwhile to use lower tails assays in the enrichment process. A change from 0.25 to 0.15 in the tails assay would reduce natural uranium requirements by 15 percent.

26. The inventory need never be used and could be passed on from reactor to reactor. In this case, the inventory charge per year, I, is given by:

$$I = rU \left[1 - (1 + s)^{30} / (1 + r)^{30} \right]$$

where r is the annual discount rate, s is the annual rate of escalation of the uranium price, and U is the initial cost of purchasing the 30 year supply. For r = .05, s = .02, and U = $300 million, the inventory charge is approximately $8.7 million per year. If s = r, the inventory charge would be zero.

We wish to acknowledge the very significant contributions to this paper by Princeton University colleagues, Robert Socolow, Frank von Hippel, and Robert Williams.

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Fig. 1.

The growing stockpile of separated civilian plutonium in noncommunist countries intended as fuel in civilian power reactors compared to the amount of plutonium in the nuclear weapons stockpiles of the United States, the Soviet Union, France, and the United Kingdom at the beginning of 1984. Estimates of the inventories are based primarily on the following data.

United States: historical data on the heat output of Department of Energy plutonium-production reactors. Soviet Union: estimate of the releases of krypton-85 to the atmosphere from Soviet reprocessing; France and United Kingdom: the capacity of their production reactors. The historical estimates of the civilian inventories of plutonium are based on public information. The projections are based on the capacities of the major commercial reprocessing facilities operating, under construction, and planned, in noncommunist countries. Figure 2 details the projected LWR fuel reprocessing capacities. We assume that gas-graphite fuel reprocessing will be ending in the late 1990s as these reactors shut down. The uncertainties in the estimates of the 1984 stockpiles are all on the order of 15 percent. (Refs. 1,2).

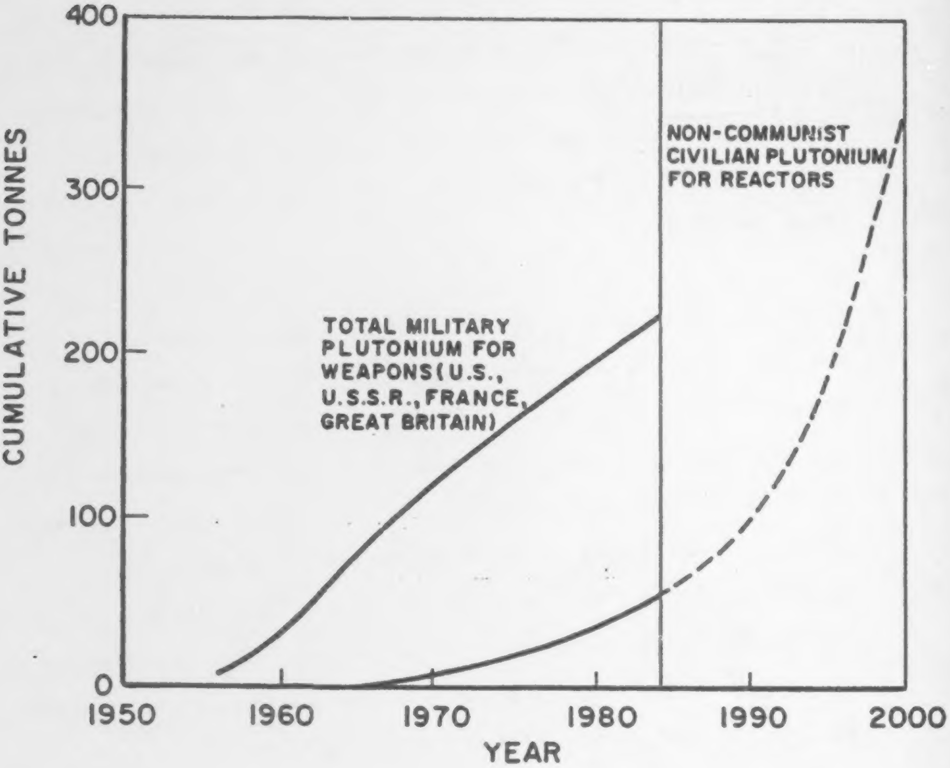
400
300
200
100
0
CUMULATIVE TONNES
1950
1960
1970
1980
1990
2000
YEAR
TOTAL MILITARY PLUTONIUM FOR WEAPONS (U.S., U.S.S.R., FRANCE, GREAT BRITAIN)
NON-COMMUNIST CIVILIAN PLUTONIUM FOR REACTORS

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Fig. 2.

Annual capacities of major reprocessing facilities for LWR fuel, operating, under construction, and planned in West Europe and Japan. We assume that a new reprocessing plant requires five years to reach its full operating capacity and that 9 kilograms of plutonium are recovered for every 1000 kilograms of uranium in the fuel reprocessed.

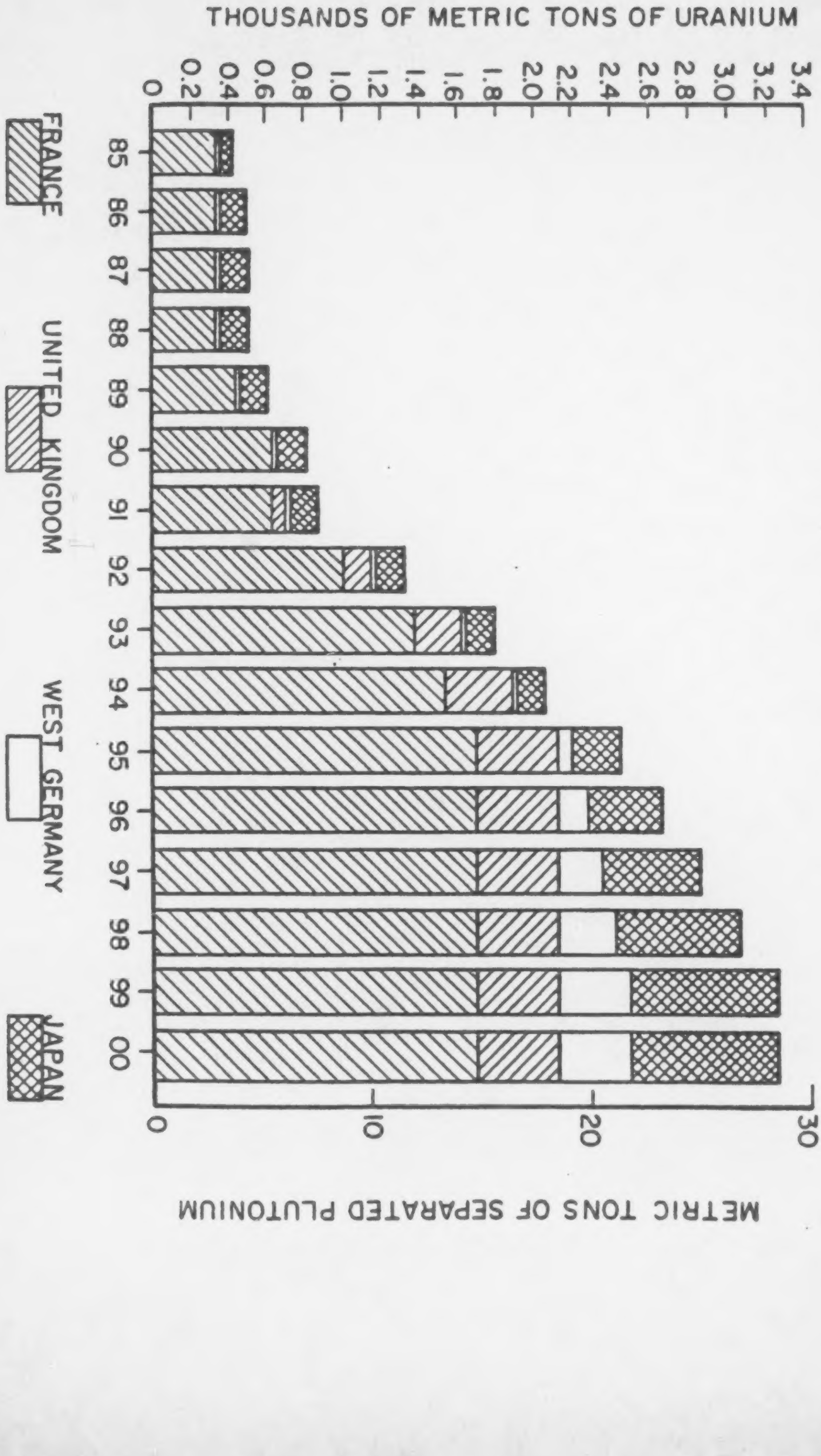
THOUSANDS OF METRIC TONS OF URANIUM
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
00
FRANCE
UNITED KINGDOM
WEST GERMANY
JAPAN
0
10
20
30
METRIC TONS OF SEPARATED PLUTONIUM

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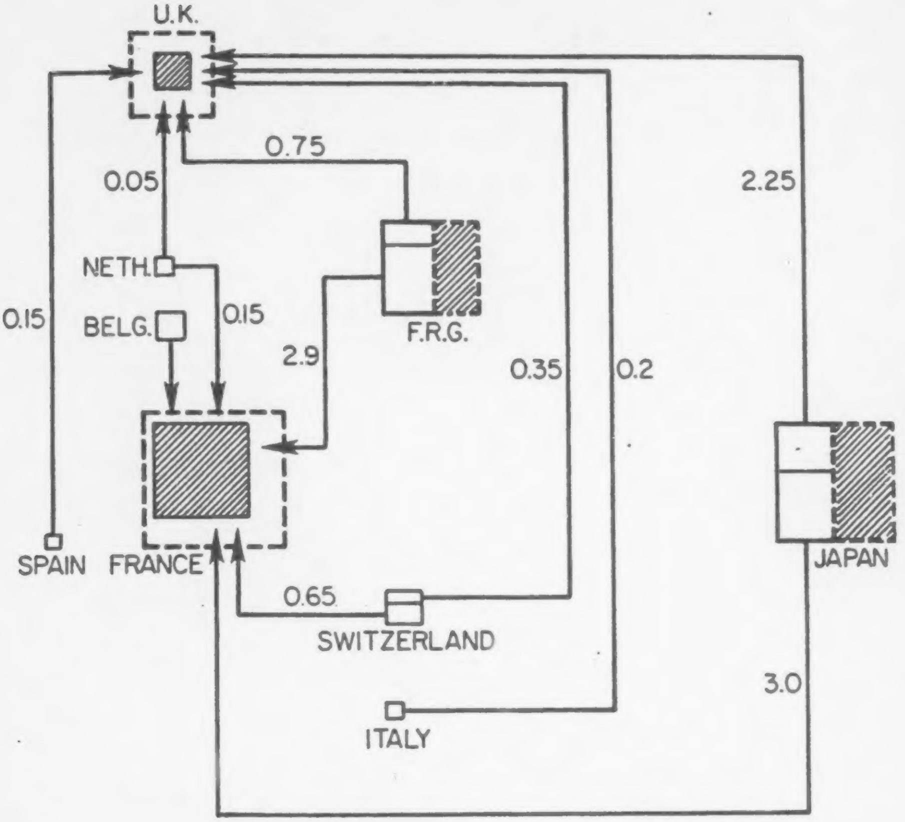
Fig. 3.

Annual amount of plutonium to be separated from LWR spent fuel at the end of the century. Most of the separated plutonium will eventually be sent back to the country originating the spent fuel. The total of 27 metric tons of plutonium per year shown is based on projected reprocessing capacities at the end of the century and already negotiated reprocessing contracts. The area of each country's square is proportional to the total plutonium produced annually in the country's nuclear reactors. The area of each dashed-outlined square or rectangle is proportional to the total plutonium separated in the country's reprocessing plants. The shaded areas are proportional to the plutonium separated from domestic fuel.

PLUTONIUM SEPARATION AND TRANSFERS
IN EUROPE & JAPAN AT END OF CENTURY


U.K.
0.75
0.05
2.25
NETH.
0.15
BELG.
0.15
F.R.G.
2.9
0.35
0.2
SPAIN
FRANCE
JAPAN
0.65
SWITZERLAND
3.0
ITALY

☐ = 2.5 TONNES Pu/y

▨ = PLUTONIUM SEPARATED FROM DOMESTIC FUEL

⬚ = PLUTONIUM SEPARATED IN COUNTRY'S REPROCESSING PLANTS

→ = INTERNATIONAL TRANSFERS OF SPENT FUEL TO BE REPROCESSED (IN TERMS OF CONTAINED PLUTONIUM)

TOTAL Pu SEPARATION SHOWN : 27 TONNES Pu/y

Fig. 4.

A map showing most of the principal facilities in Europe and Japan other than the light water reactors expected to be involved in plutonium recycle at the end of the century. There would also be approximately 50 one GWe light water reactors that would be using mixed-oxide fuel -- most of these in Japan, France and Germany. Also not shown are the breeder reactor, Superphenix 2, and a commercial-size breeder fuel reprocessing plant. France and Germany are vying for the former; and France and Britain are vying for the latter. The names shown on the map are the ones most commonly used in non-technical discussions.

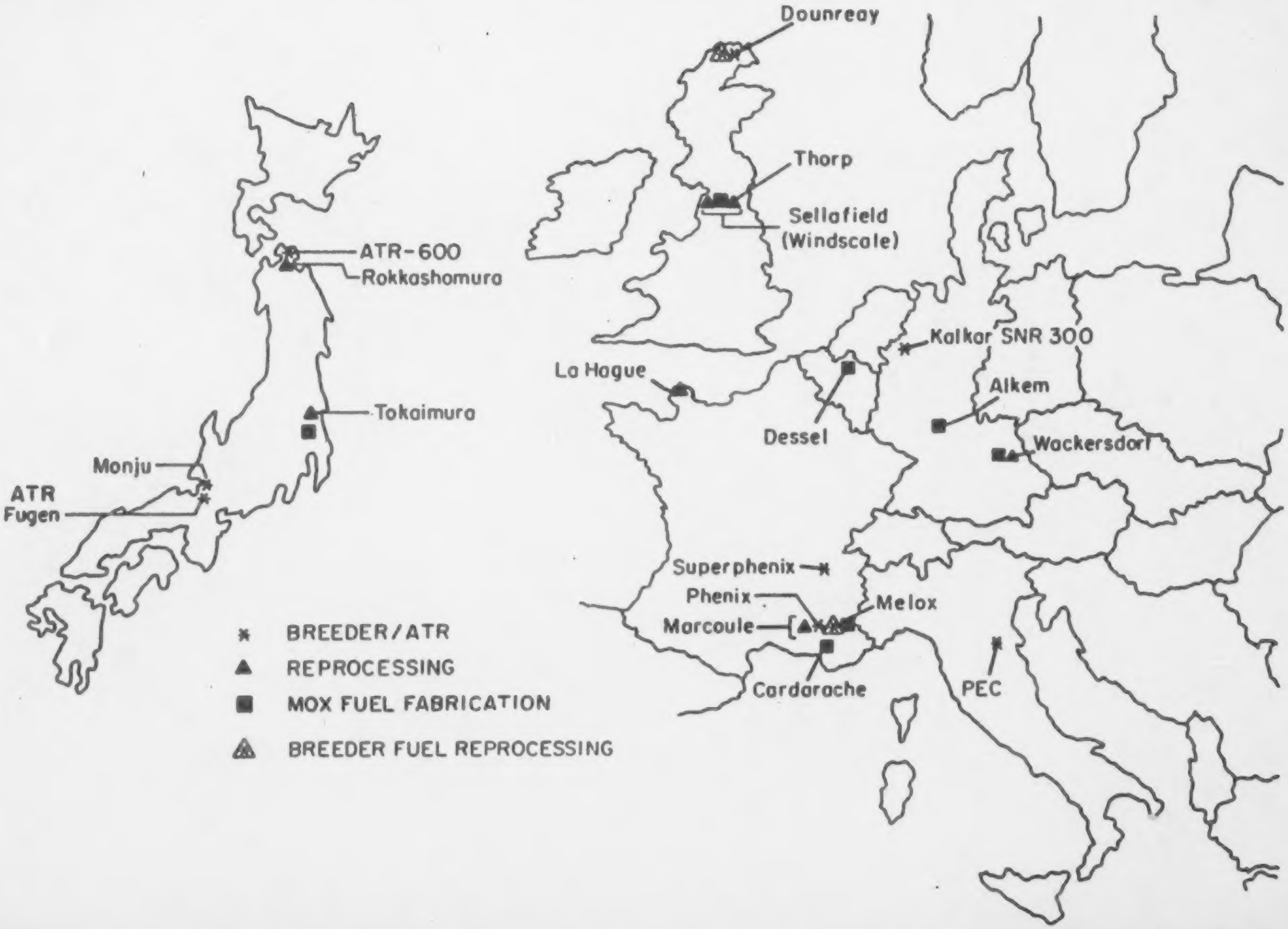

Dounreay
Thorp
Sellafield (Windscale)
ATR-600
Rokkashomura
Kalkar SNR 300
La Hague
Alkem
Tokaimura
Dessel
Wackersdorf
Monju
ATR Fugen
Superphenix
Phenix
Melox
Marcoule
Cardarache
PEC
* BREEDER/ATR
▲ REPROCESSING
■ MOX FUEL FABRICATION
△ BREEDER FUEL REPROCESSING

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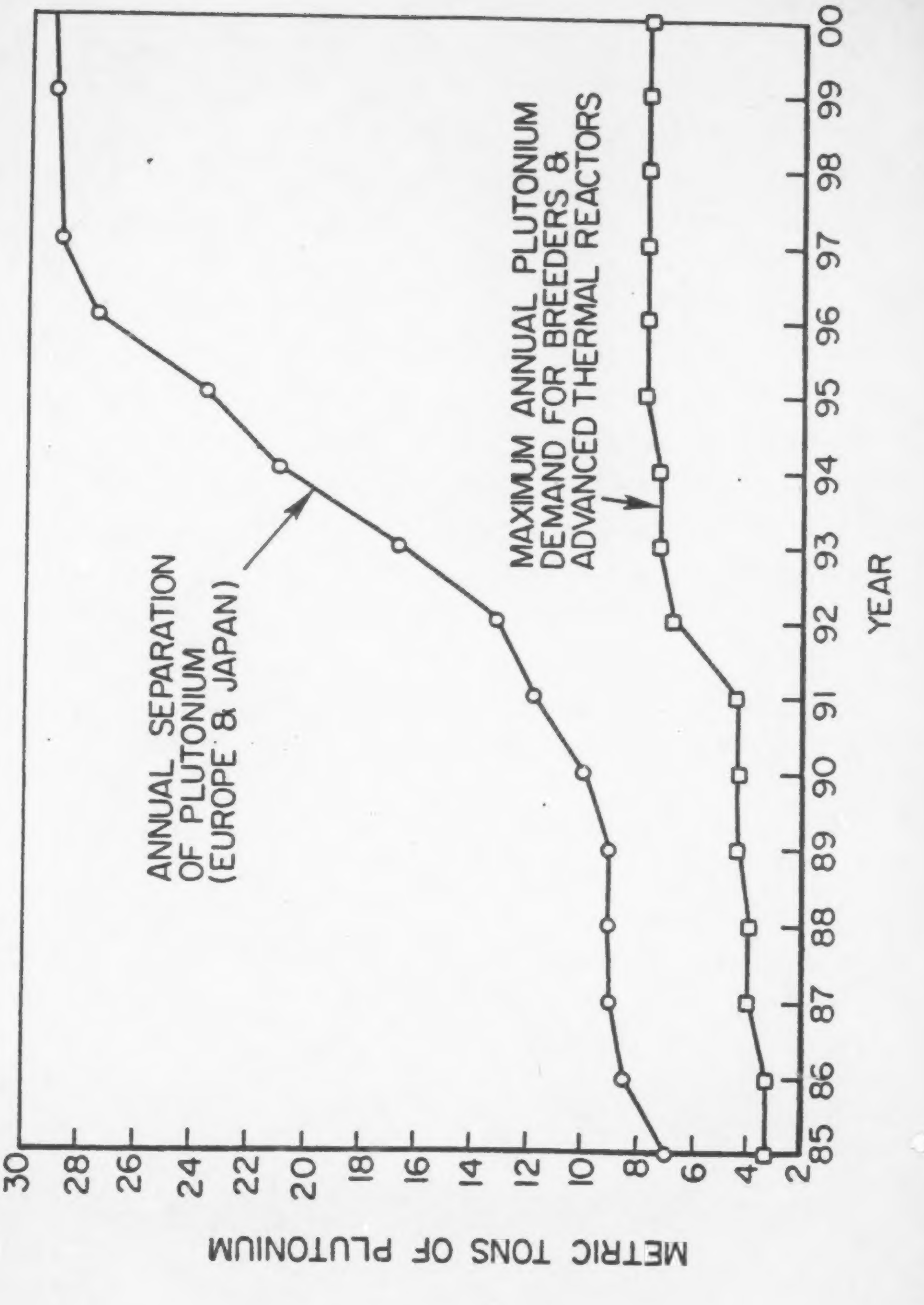
Fig. 5.

Annual separation of plutonium compared to plutonium requirements for prototype plutonium breeder and advanced thermal reactor (ATR) programs. The annual separation of plutonium is based on several assumptions: full utilization of the reprocessing capacities shown in figure 2 for LWR spent fuel; a constant annual plutonium separation rate of 4.5 metric tons of plutonium from gas-graphite fuel in France and Britain until 1995, at which time the rate decreases linearly to zero by 2000; and about 1 metric ton of plutonium separated annually from British advanced gas reactors beginning in the early to mid 1990s. At the end of the century the annual breeder and ATR demand for plutonium would include: approximately 5 metric tons per year for two Superphenix-sized breeders; 2 metric tons per year for smaller breeder prototypes in France, Japan, Great Britain, and Italy; and 0.7 metric tons per year for Japan's ATRs. These numbers assume that one new Superphenix-sized breeder reactor will be built and that the plutonium discharged from the breeder and ATRs will not be recycled.


ANNUAL SEPARATION OF PLUTONIUM (EUROPE & JAPAN)
MAXIMUM ANNUAL PLUTONIUM DEMAND FOR BREEDERS & ADVANCED THERMAL REACTORS
METRIC TONS OF PLUTONIUM
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
85
86
87
88
89
90
91
92
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95
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97
98
99
00
YEAR

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July 15, 1987

Senator J. Bennett Johnston
Chairman
Energy and Natural Resources Committee
United States Senate
Washington, D.C. 20510

Dear Chairman Johnston:

We understand that the hearing on July 16, 1987 before your committee will discuss several bills to amend the Nuclear Waste Policy Act of 1982, some of which contain language in support of the commercial reprocessing of spent fuel. For several years, we have investigated the advantages and disadvantages of commercial reprocessing. We have concluded that commercial reprocessing is not a solution to our nation's nuclear waste problems. Instead, reprocessing could aggravate these problems and would severely complicate efforts to halt the spread of nuclear explosives to other nations and terrorists.

The strongest language in support of reprocessing is found in S. 1211, introduced by Senator Hecht. This bill would postpone site characterization under the Waste Policy Act for several years until the National Academy of Sciences has conducted a study on the feasibility of reprocessing spent nuclear fuel. The findings of this bill include the statements that "reprocessing is a proven and effective technology to make the most efficient use of energy resources and to reduce the danger to the public health and safety posed by spent nuclear fuel," and that "it is appropriate at this time for the nation to reconsider the option of reprocessing spent fuel."

Senator Evans has introduced S. 1266 which would postpone site characterization and construction of a repository until after 1998 and would authorize the construction of 4 regional monitored retrievable storage sites. It would also have Congress find that reprocessing "may offer significant long-term economic and environmental benefits by recycling valuable isotopes of high energy value and by closing the back end of the nuclear fuel cycle.".

Several of these claims about reprocessing are

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Ex Officio: John P. Holdren, Frank von Hippel

either false or misleading. In addition, these bills do not consider that widescale commercial reprocessing could increase the risk of additional nations or terrorists obtaining nuclear explosives. We will discuss these points in the sections below. More detailed information and analyses can be found in the articles we have attached to this letter. We would request that this letter and the attachments to it be placed in the record of the July 16th hearing before your committee.

Reprocessing and Nuclear Waste Disposal[1]

The reprocessing of spent fuel has often been advocated as a way to improve the efficiency of radioactive waste disposal. In relation to repository design, however, the problems posed by spent fuel and by high-level waste generated during reprocessing are roughly similar. The fission product contents of spent fuel and high-level waste from reprocessing are virtually identical, and the initial heat outputs per metric ton of original uranium are similar. Neither spent fuel rods nor high-level waste solidified into glass blocks is chemically stable enough, by itself, to provide a suitable long-term barrier against the release of its contained radionuclides to ground water.

Although reprocessing would separate much of the plutonium and perhaps some of the other transuranics from the spent fuel, significant amounts of plutonium and other transuranics would still remain in the reprocessing wastes. The amount of plutonium-containing wastes would be further increased during the associated plutonium fuel fabrication processes. As a result, reprocessing would not reduce significantly the level of the long term radioactive hazard represented by spent fuel.

Reprocessing would increase the total volume of radioactive waste requiring deep geological disposal.[2] Although the volume of the solidified high-level waste would be less than that of the spent fuel, the total volume of the radioactive material produced during reprocessing and plutonium fuel fabrication that would have to be disposed in a geological repository would be significantly greater than that of the spent fuel.[3]

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[1] The following sections are based primarily on the attached articles, "Why Recycle Plutonium," and "Radioactive Waste: The Problem of Plutonium." This section on reprocessing and nuclear waste is, in addition, based on Nuclear Energy Agency, The Economics of the Nuclear Fuel Cycle (Organization for European Cooperation and Development, Paris, 1985) and "Final Report of the Project Group on Alternative Entsorgung" (KWA 2190/1, Karlsruhe Nuclear Research Center, Karlsruhe, Federal Reqpublic of Germany, 1984).

[2] Frank von Hippel, "Nuclear Fuel Reprocessing and Radioactive Waste Disposal," paper prepared at the request of Energy Research Foundation, Columbia, SC, January 1983.

Based on all of these considerations, we concluded that reprocessing does not offer any decisive environmental or radiological safety advantages over the direct disposal of spent fuel. Similar conclusions were reached in the 1970s by the International Nuclear Fuel Cycle Evaluation, which brought together over 40 nations to study the various possible nuclear fuel cycles, and by the American Physical Society's Study Group on Light Water Reactor Safety. In 1984, the Alternative Disposal Techniques Project Group (PAE) of the Karlsruhe Nuclear Research Center in West Germany also reached a similar conclusion.

Reprocessing and Proliferation

As mentioned earlier, S. 1211 and S. 1266 do not consider the consequences of the establishment of commercial reprocessing on the spread of nuclear explosives to other nations or terrorists. In the United States, the concern that the development of reprocessing in industrialized nations will hasten the spread of nuclear explosives has created a cautious attitude toward reprocessing and a widespread belief that reprocessing and plutonium recycle are technologies of last resort.

Concerns about reprocessing were not limited to the Carter Administration; the Department of Defense in the Reagan Administration has also actively expressed concerns. A recent draft report by the Pentagon is reported to say that existing international guidelines are inadequate to protect shipments of separated civilian plutonium from terrorist attack (see attachment, "Pentagon Derides Policing of Plutonium").

Reprocessing and Economics

Although the proposed bills by Senators Hecht and Evans do not state that reprocessing is economical, they seem to ignore recent economic analyses that led both Congress and the U.S. nuclear industry to reject further U.S. investments in reprocessing and plutonium recycle. Despite prodding from the Reagan Administration, the U.S. nuclear industry was unwilling to finance the completion of the Barnwell reprocessing plant in South Carolina without federal support (which the government was unwilling to provide). Similarly, after many years of debate, Congress in the early 1980s refused to appropriate funds for the demonstration-size Clinch River Breeder Reactor, and the project was cancelled.

---

[3] Ibid., Table 1, citing U.S. Energy Research and Development Administration, Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle (ERDA-76-43, UC-70, 1976) Vol 1, Figs 1.1, 1.4, and 1.5.

The U.S. decision on the Clinch River Breeder has turned out to be prophetic, like Congress's earlier decision to terminate support for the development of a commercial supersonic transport (SST). Like the Soviet and the joint French and British SST programs, Western European, Japanese, and Soviet breeder programs have virtually ground to a halt. They too have discovered that breeders are significantly more expensive to build than conventional light water reactors. Even optimistic nuclear planners now agree that breeder reactors will not be built on a large scale until well into the next century.

The European and Japanese reprocessing programs have continued, however. Faced with growing stockpiles of separated plutonium, they have decided to recycle their excess plutonium in light water reactors (LWRs). Recycle of plutonium in LWRs is also uneconomical, unless, as is common in Western Europe and Japan, the cost of reprocessing is treated as a "sunk" cost. Even in this case, however, the economic benefits of plutonium and uranium recycle are marginal or nonexistent.

Reprocessing and Energy Security

Despite the poor economics, the nuclear industries in Europe and Japan often cite national energy security as a reason to proceed with reprocessing. They worry about their persistent vulnerability to oil import disruptions and about future shortages of uranium. However, the uranium savings that could be gained by recycling plutonium and uranium in LWRs are modest at best and cannot provide a country with a significant amount of energy security.

A more cost-effective strategy to reduce the consumption of uranium is to leave the fuel in a reactor longer and to recover more of the uranium 235 from natural uranium at enrichment plants. The United States is pursuing both of these options. An alternative, more effective method to provide security against uranium supply disruptions is to stockpile uranium.

Conclusion

Several of the reasons why the United States decisively rejected commercial reprocessing are even more applicable today. It is therefore doubtful that the U.S nuclear industry will decide to commercially reprocess its spent LWR fuel and to recycle it for several decades at a minimum.

Although the present Federal nuclear waste disposal program appears to be in serious disarray and might require legislative remedies, we should not turn our backs on efforts to find and characterize the most suitable deep geological repository. In any case, the reprocessing of spent nuclear fuel is not the solution to any of the problems that exist in the federal nuclear waste program.

Sincerely,

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Attachments: (1) "Why Recycle Plutonium" by David Albright and Harold Feiveson, Science, March 27, 1987; (2) "Radioactive Waste: The Problem of Plutonium" by Hartmut Krugmann and Frank von Hippel, Science, October 17, 1980; and (3) Daniel Charles, "Pentagon Derides Policing of Plutonium," New Scientist, June 18, 1987.

Perspective

Why Recycle Plutonium?

DAVID ALBRIGHT AND HAROLD FEIVESON

IN 1984, 250 KILOGRAMS OF PLUTONIUM OXIDE, SEPARATED in France from spent fuel from Japanese reactors, was returned to Japan by cargo ship. The ship carried only the plutonium; it made no intermediate stops; it was escorted partway by French and U.S. warships; and it was continuously tracked by satellite by officials in Japan (*1*).

If the nuclear industries of Europe and Japan continue with their plans to use plutonium in commercial reactors, they will, by the end of the century, have separated and placed into commerce more than 300,000 kilograms of plutonium (*2*) (Fig. 1). (For comparison, the Nagasaki bomb contained 6 kilograms of plutonium.) The extraordinary security measures applied to the French-Japanese shipment to protect the plutonium from theft and sabotage would need to be made routine on a vast scale.

This prospect derives from the decisions of several major countries, including France, Great Britain, the Federal Republic of Germany, Japan, Belgium, Switzerland, and Italy, to separate chemically the plutonium and uranium from the highly radioactive fission products contained in the spent fuel from their commercial reactors (a procedure called "reprocessing") and to recycle this plutonium and uranium into reactor fuel for breeder reactors and light water reactors. Such recycling differs from the "once-through" fuel cycle in use today in that material usable in weapons is not isolated in the latter process.

Barring a sharp turnaround in current programs, by the year 2000 or even earlier, more than 25,000 kilograms of separated plutonium may be placed in routine commerce annually (Fig. 2). Four countries—France, Great Britain, Germany, and Japan—will together separate most of this plutonium. Much will be separated from domestic fuel, but France and Britain also plan to reprocess fuel from West Germany, Japan, Belgium, Italy, the Netherlands, Spain, and Switzerland. Most of this plutonium, along with the nuclear waste, will eventually be returned to the country of origin.

After reprocessing, separated plutonium oxide will travel by truck, or a combination of truck and ship or plane in shipments across water, to fuel fabrication facilities in France, Great Britain, West Germany, Belgium, and Japan. If, on average, each shipment contains 100 kilograms of plutonium, more than 250 shipments of plutonium oxide annually will be required to transport the plutonium to these facilities. Slightly more than half of these shipments will be transported intracountry; the rest will travel from French and British reprocessing plants to other European countries and Japan.

At the fuel fabrication facilities, approximately two-thirds of the plutonium oxide will be blended with uranium oxide and fabricated into mixed-oxide (MOX) fuel elements and assemblies for light water reactors. Several hundred shipments of MOX fuel will be required each year to supply reactors in France, Germany, Japan, and elsewhere. The remaining separated plutonium will be fabricated into fuel elements for prototype breeder reactors in Britain, France, Germany, Japan, and Italy, and two Japanese heavy water reactors. The delivery of these fuel elements to the reactors will require an additional 100 shipments per year.

Neither the isotopic composition of the reactor grade plutonium nor its chemical form affords significant protection. Nuclear weapons designers have stated repeatedly that, despite its relatively high content of plutonium-240, reactor grade plutonium can be used directly in nuclear explosives. Similarly, plutonium oxide, the most common form of plutonium that leaves civilian reprocessing plants or that could be retrieved from unirradiated MOX fuels, could be used in nuclear explosives without reduction of the oxide to the metal. To guard against diversion of the material to weapons by terrorists, separated plutonium and fresh MOX fuel will have to be treated as virtually equivalent to weapon-grade plutonium (*3*). Given the scope of the commerce in separated plutonium, it is clear that stringent protection systems will be required.

Virtually any country engaged in plutonium recycling would have available large quantities of readily accessible fissile material. If a country had produced all the components of nuclear weapons other than the fissile material cores, it could reduce the time between a decision to build nuclear weapons and the achievement, on a potentially large scale, from years to weeks. Such "latent proliferation" would make it easy for governments to hide a nuclear weapons program within an ambitious civilian program.

Reprocessing and recycling are concentrated in countries that have nuclear weapons or support the Non-Proliferation Treaty. However, the emergence of a commercial market in MOX fuels, even if initially restricted to Europe and Japan, would allow other countries, some with dubious commitment to nonproliferation, to gain access to weapons-usable material. The emergence of a plutonium market would also make it extremely awkward for nuclear suppliers in the United States, Europe, and Japan to deny reprocessing and fabrication facilities able to produce such material relatively quickly to other countries.

One source of interest in reprocessing has been the view that reprocessing could improve the efficiency of radioactive waste disposal. This, combined with the willingness of France and Great Britain to reprocess foreign fuel, offered a politically attractive way for some countries to postpone dealing with their own waste disposal problems. However, the fission product contents of spent fuel and high-level waste from reprocessing are essentially identical, and the heat outputs per metric ton of original uranium are similar. Although reprocessing would separate much of the plutonium and perhaps some of the actinides from the spent fuel, significant amounts of plutonium and actinides would still end up in the reprocessing wastes. As a result, final disposal of unreprocessed spent fuel does not appear to represent a significantly greater

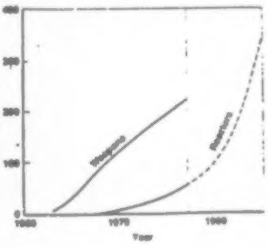

Fig. 1. The growing amount of separated civilian plutonium in noncommunist countries intended as fuel in civilian power reactors compared with the amount of plutonium in the nuclear weapons arsenals of the United States, the Soviet Union, France, and the United Kingdom at the beginning of 1984.

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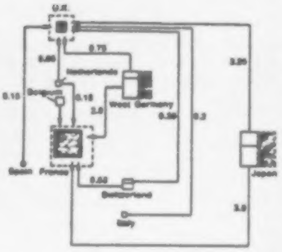

Fig. 2. Annual amount of plutonium to be separated from light water reactor spent fuel at the end of the century. Most of the separated plutonium will eventually be sent back to the originating country. A total of about 27 metric tons of plutonium per year is based on projected reprocessing capacities at the end of the century and already negotiated reprocessing contracts. The area of each country's square is proportional to the total plutonium that would be separated annually from spent fuel produced in the country plus, in the case of France and the United Kingdom, sent to it from abroad. The area of each dashed-outlined square or rectangle is proportional to the total plutonium that would be separated in the country's reprocessing plants. The shaded areas are proportional to the plutonium that would be separated from domestic fuel. The arrows represent international transfers of spent fuel to be reprocessed (in terms of contained plutonium).

environmental hazard than disposal of high-level wastes from reprocessing. Three countries with major nuclear programs—the United States, Canada, and Sweden—have decided to place their spent fuel in long-term storage without reprocessing (*4*, *5*).

Although the waste disposal rationale for reprocessing appears to have weakened, a second motivation remains strong—that the energy content of the plutonium contained in the spent fuel must be captured. Until recently, the nuclear industries in the industrialized countries expected that this recycled plutonium would be used for the initial loadings of prototype and commercial plutonium breeder reactors. However, because of greatly reduced demand for electricity, the higher costs of breeder reactors compared to light water reactors, and larger than expected uranium resources, breeder reactor programs worldwide have slowed dramatically.

Breeder programs can thus absorb only a small portion of the plutonium scheduled or planned to be separated in this century. Unless current reprocessing programs are curtailed, there will be a surplus of separated plutonium of at least 100 metric tons by 1995 and 200 metric tons by the year 2000.

As the commercial viability of the breeder recedes and stockpiles of separated plutonium grow, the nuclear industries in Europe and Japan have initiated programs to use plutonium fuels in current light water reactors. Recycling would in practice reduce uranium feed and enrichment requirements by about one-quarter—the savings depending on the price of uranium and enrichment. At current uranium and enrichment prices, fuel cycles that use recycled uranium and plutonium would cost about 1 mill/kWh more than the normal once-through cycle. The price of uranium would have to more than triple from its present value of less than $83 per kilogram before the savings in uranium costs made up for the extra costs of reprocessing, of plutonium storage, and of MOX fabrication (*6*). Even if the costs of reprocessing are disregarded, the economic benefits of plutonium and uranium recycle are marginal or nonexistent.

Despite the poor economics, the nuclear industries in Europe and Japan often cite national energy independence as a reason to push ahead with reprocessing and thermal recycle. This goal draws mainly upon the persistent vulnerability of these areas to oil import disruptions. However, the uranium savings that could be gained by the recycling in light water reactors of all the plutonium and uranium planned for separation in this century would be only about 100,000 metric tons. For most countries, thermal recycling would lessen their dependence on foreign uranium only at the price of an increased dependence on a steady and assured flow of plutonium separated in foreign reprocessing plants. It would also make them dependent on the integrity of international safeguards and physical security arrangements to prevent the theft or diversion of the separated plutonium.

Countries concerned about the security of their uranium supply may, instead, find it cost-effective to reduce the consumption of uranium by higher burnup of reactor fuel or more complete recovery of uranium-235 from natural uranium at enrichment plants. In addition, uranium costs so little per unit energy-equivalent that it can be readily and economically stockpiled to provide a buffer against a supply disruption.

Reprocessing and recycling on the scale now envisioned would create a challenge of nightmarish proportions for those seeking to prevent diversion of plutonium to weapons. The reasons for European and Japanese interest in recycling are complex—for example interest in Germany and Japan in postponing domestic debates on waste disposal and the drive in France to stay at the forefront of nuclear technology. But there do not appear to be any clear economic motives. Indeed, with the price of uranium low, and expected to remain so for several years at least, recycling appears to be an economically poor proposition.

It may not be too late for the international community to persuade the countries embarking on these critical activities to abandon plans for plutonium recycling and to defer indefinitely commercial reprocessing not devoted directly to research and development on breeder reactors.

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7. We wish to acknowledge the contributions of R. Socolow, F. von Hippel, and R. Williams.

Radioactive Waste: The Problem of Plutonium

Abstract. *Systems under development for the recovery of plutonium from spent fuel and its recycling in fresh fuel would not significantly reduce either the total α-activity or the amount of fissile plutonium in radioactive waste relative to what is possible with once-through fuel cycles.*

In April 1977, as a result of increasing concerns that the recovery and recycling of plutonium from "spent" nuclear reactor fuel could ease its diversion to weapons uses, the U.S. government deferred plans for the commercialization of plutonium recycling technologies and urged other governments to do likewise until alternative, possibly more proliferation-resistant nuclear fuel cycles had been examined. Nevertheless, proposals to continue indefinitely the present reliance on once-through fuel cycles have drawn a number of criticisms:

1) Without the savings in uranium that plutonium recycling would make possible, the world's resources of high-grade uranium ore will be more rapidly exhausted.

2) The long-term toxicity of radioactive wastes will be significantly increased if the plutonium is not recycled and "burned up."

3) If the spent fuel is buried, the repository sites will become potential "plutonium mines" for future groups desiring nuclear weapons material.

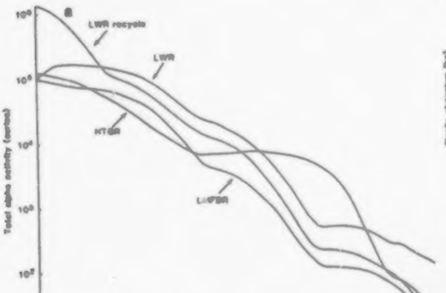
Issue 1 has already been dealt with elsewhere (*1*). In this report we discuss issues 2 and 3 and show that the quantities of plutonium and other long-lived α-emitters in the spent fuel from a once-through fuel cycle need be no larger than those projected for the radioactive wastes from the standard plutonium recycling systems.

The radiotoxicity and thermal energy output of spent light-water reactor (LWR) fuel after a few hundred years will be dominated by the α-decays of a few heavy transuranic radionuclides (*2*, *3*). The toxicity of the transuranics is very uncertain, however, because, depending upon their chemical state, the wall of the human gastrointestinal tract may or may not be a very effective barrier to their absorption into the body (*4*). Even slight differences in water chemistry have been found to change the potential uptake of plutonium by orders of magnitude, for example (*5*). We therefore do not follow here the usual procedure of measuring the toxicity of the transuranics by using official ingestion limits. Instead we have chosen to quantify the presence of the transuranics and other α-emitters by a physical measure, the total level of α-activity (*6*).

Figure 1a shows the total α-activity in the waste streams from the generation of 1 gigawatt-year of electric energy [1 GW-year (e)] by the current low-enriched uranium once-through LWR fuel cycle compared with the corresponding α-activities in the wastes from three alternative fuel cycles. Two of these alternatives involve the recycling of plutonium in LWR's and liquid-metal fast breeder reactors (LMFBR's). These are the fuel cycles on which the most development work has been done during the past decade. We have assumed that a total of 2 percent of the plutonium and uranium and 100 percent of all other α-emitters present in the spent fuel prior to reprocessing find their way into the fuel reprocessing and refabrication wastes (*7*). The third alternative fuel cycle is a once-through high-temperature, gas-cooled reactor (HTGR) system, which has been designed to be highly uranium-efficient and to produce a minimum of plutonium subject to the constraint that the fuel does not contain other chemically separable weapons-usable material (see below).

It will be seen from Fig. 1a that plutonium recycling in LWR's and LMFBR's reduces the α-activity in the wastes by factors of only about 2 and 4, respectively, relative to the standard once-through LWR fuel cycle for the period during which the toxicity of the wastes is dominated by the transuranics (between approximately a few hundred and 10^5 years after discharge from the reactor). This is comparable to or less than the reduction that is possible for decay times shorter than 10^4 years if one were to use the alternative, once-through fuel cycle.

The surprisingly small reduction of α-activities realized by recycling is due to the fact that plutonium is exposed in recycling to more neutron bombardment than in once-through fuel cycles. As a result, a significant fraction of the long-lived α-activity in the wastes from recycling is associated with transuranics (americium in particular) built up by neutron capture on plutonium. This effect is considerably reduced in the LMFBR plutonium fuel cycle because of the significantly reduced probability of nonfission capture by the transuranics of "fast" (energetic) LMFBR neutrons. But, since the LMFBR fuel cycle would



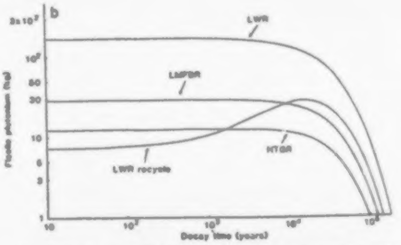


Fig. 1. Total α-activities (a) and ^{239}Pu inventories (b) in the radioactive wastes from the generation of 1 GW-year (e) by alternative nuclear fuel cycles as a function of time after discharge from the reactor. The abbreviations *LWR* and *HTGR* refer, respectively, to a light-water reactor and a high-temperature, gas-cooled reactor, both operating on a once-through fuel cycle (see text); *LWR recycle* and *LMFBR* refer, respectively, to a light-water reactor fuel cycle in which self-generated plutonium is recycled at equilibrium and a liquid-metal fast breeder reactor operating on a plutonium fuel cycle.

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recycle about twice as much plutonium per gigawatt-year of electric energy as the LWR, twice as much plutonium would be lost to waste (for the same fractional losses).

The initial α-activity of the once-through thorium-uranium HTGR fuel is lower than that of the once-through uranium fuel. After 10^4 years, however, the α-activity of the thorium-based fuel declines more slowly because the product of neutron capture on thorium, ^{233}U (half-life, 1.62×10^5 years), has a longer half-life than ^{239}Pu (half-life, 0.24×10^5 years).

The concern about spent fuel repositories becoming "plutonium mines" stems from the fact that a 1000-MW (e) LWR on the current once-through fuel cycle discharges about 175 kg of ^{239}Pu per full power year [that is, for each gigawatt-year of electric energy produced]. Only about 10 kg would be required to make the equivalent of the bomb that destroyed Nagasaki (*8*). It is therefore of interest to consider the extent to which plutonium recycling would lessen this problem.

In Fig. 1b we compare the ^{239}Pu in the waste from 1 GW-year (e) of fission power by a once-through LWR fuel cycle with the corresponding ^{239}Pu inventories in the wastes from plutonium recycling in LWR's and LMFBR's and from the once-through HTGR fuel cycle with low ^{239}Pu production. Plutonium recycling in both LWR's and LMFBR's reduces the ^{239}Pu in the wastes by approximately one order of magnitude relative to the once-through LWR case. This is less than might be naively expected on the basis of the 2 percent plutonium loss rate to waste assumed for the plutonium recycling cases. The inventories of ^{239}Pu in the spent fuel are two (LWR) and eight (LMFBR) times larger for the recycling systems than for the once-through LWR cycle, however, and, especially in the case of the LWR recycle wastes, there are substantial inventories of ^{243}Am (half-life, 7300 years), which decays into ^{239}Pu (hence the rise in the amount of ^{239}Pu in the wastes from this fuel cycle after 1000 years).

The curve for the once-through HTGR fuel cycle in Fig. 1b indicates that there are alternatives to plutonium recycling that accomplish a similar reduction in the quantity of ^{239}Pu in radioactive wastes. In this case the reduction has been achieved principally by reducing the concentration of ^{238}U in the fuel (^{239}Pu is created by neutron capture on ^{238}U). This approach has been pursued only to the point where the ^{235}U enrichment of the uranium in the fresh LWR fuel rises to 20 percent, because highly enriched uranium is itself nuclear weapons-usable material. For an increase from the 3 percent enrichment characteristic of the LWR once-through fuel cycle, however, this corresponds to a sevenfold reduction in the amount of ^{238}U associated with a given amount of ^{235}U in the fuel. The fuel-extending value of the displaced ^{238}U is maintained by substituting thorium (*9*). An additional, although less dramatic, reduction in the ^{239}Pu content of the spent HTGR fuel has been achieved because the HTGR fuel is driven to high "burnups" (measured in terms of the thermal energy release per kilogram of heavy metal in the fuel). This results in an increased fraction of the ^{239}Pu produced in the fuel being fissioned in place or being converted into higher transuranics.

Thus reductions in the plutonium and overall transuranic content of radioactive wastes comparable to those that are achieved in the standard plutonium recycling systems can be accomplished with refined once-through fuel cycles. These findings apply to the plutonium recycling technology that has been developed to date. Future technology might reduce the quantities of plutonium and other transuranic elements in the radioactive waste streams from recycle systems to levels well below those achievable with once-through systems. The plutonium in recycle systems passes through so much plumbing and machinery, however, and goes through so many changes in chemical and physical state that reducing losses by a large amount may well be quite costly. Furthermore, the transmutation of the average higher transuranic atom into shorter-lived fission products in reactors would take many cycles. Even with no leakage, it would take 100 years of very careful recycling in a breeder reactor to destroy 90 percent of the neptunium, americium, and curium that would otherwise go into the reprocessing wastes (*10*).

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7. The isotopic inventories in the LWR (which we assume for specificity is a pressurized water reactor) and LMFBR spent fuel are taken from C. W. Kee, A. G. Croff, and J. O. Blomeke [*Updated Projections of Radioactive Wastes to Be Generated by the U.S. Nuclear Power Industry* (Publication ORNL/TM 5427, Oak Ridge National Laboratory, Oak Ridge, Tenn., 1976)]. The spent fuel isotopic inventory for the once-through HTGR fuel cycle is taken from E. Teuchert [*"Once Through" Cycles in the Pebble Bed HTR* (Publication Jül-1470, Kernforschungsanlage Jülich, Jülich, West Germany, 1977)] for an initial ^{232}Th/^{235}U ratio of 1.9, a uranium enrichment of 20 percent, and an average fuel "burnup" of 100 MW-day (thermal) per kilogram of heavy metal. Since Teuchert does not give the inventories of all the α-emitters of interest, the missing ones were derived from those given by H. J. Rütten [*Daten abgebrannter Brennelemente verschiedener Reaktoren und Brennstoffzyklen ermittelt mit dem Computercode ORIGEN-EXJÜL* (internal report KFA-IRE-IB-12/79, Kernforschungsanlage Jülich, Jülich, West Germany, 1979)]. Rütten's numbers are for 36 percent higher burnup fuel than Teuchert's. Each of his inventories of α-emitters created by neutron capture was therefore reduced by the ratio of the inventories (Teuchert's/Rütten's) of the nearest precursor listed by both authors on the dominant neutron buildup chain leading to the isotope in question. This procedure leads to a slight overestimate of the HTGR spent fuel α-activity and ^{239}Pu inventory.
8. We ignore the fissile isotope ^{241}Pu here since it has such a short half-life (13 years). The critical spherical mass of ^{239}Pu diluted with up to an equal amount of nonfissile ^{240}Pu + ^{242}Pu in a metallic α-phase surrounded by a thick uranium neutron reflector is 4 to 5 kg. The complete fissioning of 1 kg of heavy metal would yield energy approximately equal to the explosion of 20,000 tons of high explosive [T. B. Taylor, *Ann. Rev. Nucl. Sci.* 25, 407 (1975)].
9. Some of the ^{238}U is transmuted by neutron capture and subsequent radioactive transformations into ^{239}Pu, some of which is fissioned in place. Thorium-232 is similarly converted into fissile ^{233}U. Pure ^{233}U is weapons-usable but differs from ^{239}Pu in that, like ^{235}U, it will be "isotopically denatured" for nuclear-weapons purposes as a result of its dilution by the ^{238}U in the fuel [see (*1*)].
10. See figure 7D1 in (*2*), p. S116.

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SCIENCE

Pentagon derides policing of plutonium

Daniel Charles, Washington DC

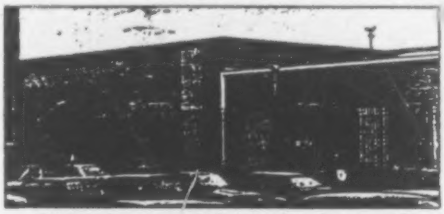
TERRORISTS could easily hijack plutonium in transit from Sellafield and other commercial nuclear reprocessing plants, according to a report from the Pentagon. The criticism of existing international standards for the security of plutonium has ignited a row within the Reagan administration and delayed release of several official reports on the subject.

In a draft report, the Department of Defense asserts that existing guidelines for moving nuclear fuels, laid down by the International Atomic Energy Agency, are inadequate to protect plutonium and highly enriched uranium from terrorist attack. According to government sources, the Pentagon advocates increased efforts to persuade foreign countries to strengthen security for these materials. This stand puts Pentagon officials at odds with nuclear officials from the Departments of Energy and of State, as well as those from the US's Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission.

Congress last year ordered the five government agencies to submit reports by February on whether foreign countries protect plutonium and highly enriched uranium adequately from seizure by terrorists. The dispute has delayed release of the reports, and officials from the White House are now said to be attempting to resolve the agencies' differences.

Government sources say that the State Department, backed by the Department of Energy, believes that the existing broad guidelines are adequate, and that measures to force other nations to increase security for plutonium originating in the US would be unnecessarily disruptive.

The Pentagon's concern about security of plutonium stems largely from plans by Britain, France, West Germany and Japan to increase the reprocessing of spent reactor fuel to extract plutonium. As new reprocessing facilities, such as Britain's new plant, called THORP, now being built at Sellafield, are completed, the global stock of commercially owned plutonium, and the efforts required to protect it, are expected to increase dramatically.



Britain's plutonium stockpile: is it safe on the open road?

According to a study by David Albright and Harold Feiveson published in *Science* (27 March 1987, p 1555), the total amount of plutonium separated in states outside the Soviet bloc could increase to more than 350 tonnes by the year 2000 from the current total of 60 tonnes. The authors expect the shipment of more than 25 000 tonnes of plutonium annually, almost half of it across national borders. Less than 10 kilograms of plutonium will fuel a nuclear bomb.

Richard Perle, until recently the US's assistant secretary of defence, often expressed fears about the growing use of plutonium for nuclear power in Western Europe and in Japan. He and other officials from the Pentagon feared that large civilian stockpiles and frequent shipments of plutonium would make it easier for terrorists to steal material. "I think that traffic in plutonium ought to be halted and halted absolutely," Perle told a nonproliferation conference in Geneva in 1985.

In 1984, nuclear officials from France and Japan had a foretaste of the kind of security measures that may soon become routine. The US government forced them to revise drastically their plans for shipping 250 kilograms of plutonium bound for Japan from the French reprocessing facility at La Hague. The uranium in the reactor fuel from which the plutonium was extracted had been enriched in the US, so the Japanese needed approval from the American government for the shipment.

Instead of being handled as a routine shipment with a few extra guards, as originally planned, the plutonium was placed in a modified cargo ship equipped with sophisticated communications gear, and guarded by a specially cleared security force. French, Japanese and American warships escorted the cargo at various times, and officials in Japan monitored its progress by satellite.

"Had it not been for the intervention of the White House," Perle told a congressional committee in early March, "we might have seen that shipment take place without proper precautions."

The present row between the State and Defense Departments intensified during the preparation of an agreement on nuclear cooperation with Japan. Officials at the Pentagon intervened in negotiations being handled by the State Department, to insist on stronger security. "We crashed the party," Perle told a congressional committee in early March. "We invited ourselves to meetings; we made a general nuisance of ourselves."

Ironically, Perle, who was one of the Reagan administration's best-known hawks, found his support for restrictions on the widespread commercial use of plutonium aligned with the views of liberal Democrats.

It is not yet clear whether Perle's successor, Frank Gaffney, will defend vigorously the Pentagon's draft against proposed revisions. ☐

OBSERVER David Austin
IT HAS A BETTER CHANCE OF GETTING OFF THE GROUND THAN THE LIBERAL DEMOCRATIC ALLIANCE.

Britain's plutonium trade to soar

THE BULK of plutonium recovered after military and civilian nuclear reprocessing in Britain is stored at Sellafield under round-the-clock surveillance. Civilian stocks of plutonium oxides exceed 23 tonnes, with a further 0·5 tonnes in solution.

For obvious reasons, the industry and government is loathe to divulge details of security arrangements. Responsibility lies chiefly with the 670-strong United Kingdom Atomic Energy Police Force. It provides cover both at sites such as Sellafield, and for nuclear material in transit.

At present, British Nuclear Fuels, which carries out reprocessing at Sellafield, sends consignments of plutonium oxide to Japan by sea and fuel assemblies containing plutonium to Dounreay in northern Scotland by air. This latter traffic, in packages weighing 3 tonnes or so and containing around 10 kilograms of plutonium, is relatively small. In the past decade there have been only three or four shipments of plutonium to Japan, but there are 40 shipments a year to Dounreay via Carlisle airport. Airborne traffic in plutonium is expected to jump dramatically over the next five years once THORP, the new reprocessing plant at Sellafield, comes into operation. Plutonium would be sent by air to Japan. ☐

TESTIMONY OF RON LURIE, MAYOR

CITY OF LAS VEGAS, NEVADA

BEFORE THE

SENATE ENERGY COMMITTEE

JULY 16, 1987

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, I WOULD LIKE TO THANK YOU FOR THIS OPPORTUNITY TO TESTIFY ON THE FOUR BILLS BEFORE YOU TODAY. AS YOU KNOW, THE CITY OF LAS VEGAS IS LOCATED 100 MILES SOUTHEAST OF YUCCA MOUNTAIN, WHICH IS THE SITE IN NEVADA BEING CONSIDERED AS THE NATION'S FIRST UNDERGROUND NUCLEAR WASTE REPOSITORY. THE CITY IS THE CENTER OF A RAPIDLY GROWING POPULATION OF 600,000 AND, UNLIKE MANY CITIES IN THE EAST, ALL MAJOR INTERSTATES, U.S. HIGHWAYS, AND MAINLINE RAIL TRACKS WHICH WOULD BE USED TO SHIP NUCLEAR WASTE IN SOUTHERN NEVADA TRAVERSE LAS VEGAS. FOR THIS REASON, THE CITY IS KEENLY INTERESTED IN ALL BILLS WHICH CONCERN THE STORAGE, TRANSPORTATION OR DISPOSAL OF RADIOACTIVE NUCLEAR WASTE.

FIRST, YOU SHOULD BE AWARE THAT THE CITY OF LAS VEGAS HAS TAKEN FORMAL ACTION IN OPPOSITION TO THE LOCATION OF AN UNDERGROUND REPOSITORY AT YUCCA MOUNTAIN. THIS ATTITUDE IS NOT DERIVED FROM ANY "NOT IN MY BACKYARD" SYNDROME, BUT COMES FROM THE INDEPENDENT TECHNICAL STUDIES BEING CONDUCTED BY THE STATE OF NEVADA. WHILE PREVIOUS TESTIMONY HAS EXPLAINED OUR CONCERNS IN DETAIL, SUFFICE IT TO SAY THAT THEY FOCUS ON THE POTENTIAL FOR AN EARTHQUAKE, UNKNOWNS REGARDING GROUNDWATER TRAVEL, NEARBY ATOMIC WEAPONS TESTING, AND THE POSSIBILITIES FOR THE DEGRADATION OF WATER RESOURCES FOR HUMAN CONSUMPTION OR CROP IRRIGATON.

NOW I'D LIKE TO TURN TO SENATE BILLS 1211, 1007, 1141, AND 1266, WHICH ARE UNDER DISCUSSION TODAY. THE CITY HAS THOROUGHLY REVIEWED THESE BILLS AND IN VARYING DEGREES SUPPORTS EACH ONE. MORE IMPORTANTLY, WE APPLAUD EFFORTS TO REMEDY THE NUCLEAR WASTE PROCESS, WHICH IS CLEARLY NOT WORKING. IN THE PAST, THE CITY'S TESTIMONY HAS RECOMMENDED ACTIONS TO PLACE THE DERAILED DEPARTMENT OF ENERGY PROCESS BACK ON TRACK, AND WE ARE ENCOURAGED TO SEE PROGRESS IN THIS DIRECTION.

REGARDING SENATE BILL 1141 ENTITLED THE "NUCLEAR WASTE ENERGY POLICY ACT OF 1987," LAS VEGAS STRONGLY ENDORSES THE PROVISIONS OUTLINED IN THIS BILL. THE CITY BELIEVES WASTE SHOULD BE STORED AT A MONITORED RETRIEVAL STORAGE (MRS) FACILITY FOR A PERIOD OF 50 YEARS TO FACILITATE COOLING. ONCE THE 50 YEARS HAS PASSED, TRANSPORTATION OF THE WASTE WOULD BE SAFER. THIS OCCURS BECAUSE THE WASTE WOULD ALREADY BE CONSOLIDATED IN ONE LOCATION, AND THOSE CHARGED WITH SHIPPING IT WOULD HAVE THE EQUIPMENT AND TRAINING NOT LIKELY TO BE AVAILABLE AT EACH NUCLEAR POWER PLANT. ALSO, SINCE ALL THE WASTE WOULD BE CONSOLIDATED IN ONE PLACE, LONG TRAINS CARRYING ONLY RADIOACTIVE WASTE COULD BE ASSEMBLED, THUS ELIMINATING THE NUMEROUS TRUCKLOADS WHICH WOULD BE REQUIRED TO CARRY THE SAME VOLUME OF WASTE IF IT WERE IN DISPERSED LOCATIONS.

50-YEAR STORAGE OF WASTE AT POWER PLANTS WHICH GENERATE

IT ALSO HAS MERIT BECAUSE SAFETY PROCEDURES ARE ALREADY IN EFFECT AT THESE SITES. ALSO, THIS METHOD WOULD ELIMINATE TRANSPORTATION DANGERS FOR THE NEAR FUTURE, AS NO SHIPPING WOULD BE REQUIRED UNTIL THE 50 YEAR COOLING PERIOD EXPIRES.

THE CITY ALSO ENDORSES SENATE BILL 1211, THE "NUCLEAR WASTE REPROCESSING STUDY ACT OF 1987." IT IS PRESENTLY CONVENTIONAL WISDOM THAT REPROCESSING ISN'T NECESSARY IN THE UNITED STATES, BECAUSE URANIUM IS SO CHEAP AND ABUNDANT IN THIS COUNTRY. HOWEVER, NO SPECIFIC STUDY HAS ANALYZED THIS PREMISE, NOR CONSIDERED THE FEASIBILITY OR ECONOMICS OF REPROCESSING SPENT NUCLEAR FUEL IN THE FUTURE. IN ADDITION, WHILE IT MAY NOT NOW BE ECONOMICALLY PRACTICAL TO REPROCESS, THE HUGE AMOUNT OF MONEY WHICH WILL BE SPENT IN THE NEXT 25 YEARS ON THE STORAGE OF NUCLEAR WASTE MANDATES THAT ANY TECHNOLOGY WHICH LOWERS THE VOLUME OF WASTE OR INCREASES SAFETY DESERVES ANALYSIS. FINALLY, THE FACT THAT THE STUDY PRESENTED IN THIS BILL MUST BE COMPLETED WITHIN TWO YEARS MEANS THAT NO DELAYS IN THE CURRENT DEPARTMENT OF ENERGY EFFORT SHOULD BE CAUSED BY STUDYING THE FEASIBILITY OF REPROCESSING.

SENATE BILL 1266 ECHOES MANY OF THE CITY'S PAST RECOMMENDATIONS, AND THUS MERITS THE CITY'S SUPPORT. FOR EXAMPLE, IT STATES THAT THE "FEDERAL NUCLEAR WASTE PROGRAM IS IN SERIOUS DISARRAY, AND REQUIRES A SUBSTANTIAL MID-COURSE

CORRECTION," THAT THOSE STATES RESPONSIBLE FOR THE GENERATION OF NUCLEAR POWER SHOULD ALSO BEAR THE BURDEN OF STORAGE AND DISPOSAL, AND THAT "MONITORED RETRIEVAL STORAGE FACILITIES REDUCE HEAT AND RADIOACTIVITY OVER TIME." THESE EXACT STATEMENTS HAVE BEEN MADE IN PAST LAS VEGAS TESTIMONY TO VARIOUS SENATE COMMITTEES.

THE CITY ALSO SUPPORTS THE INTENT OF THIS BILL, WHICH IS TO LOCATE MRS SITES IN VARIOUS REGIONS OF THE COUNTRY, SO THAT ONE REGION ISN'T CHOSEN TO STORE AND DISPOSE OF ALL OF THE NATION'S NUCLEAR WASTE. ALSO ENDORSED IS THE CRITERION WHICH STATES THAT MRS SITES SHOULD BE LOCATED NEAR THE GENERATORS OF NUCLEAR POWER, AND THAT TRANSPORTATION DISTANCES SHOULD BE MINIMIZED.

THE TIMING FOR COMPLETION AND AVAILABILITY FOR ACCEPTANCE OF NUCLEAR WASTE, JANUARY 31, 2002, IS CONSIDERED REASONABLE, AS IS THE CONCEPT TO EXCLUDE ANY STATE FROM AN MRS WHICH ALREADY HAS A REPOSITORY. SENATE BILL 1266 ALSO MANDATES COMPENSATION TO A STATE WHICH AGREES TO ACCEPT AN MRS. THIS PROPOSAL IS ALSO CONSIDERED WORTHWHILE BY THE CITY OF LAS VEGAS, PARTICULARLY SINCE A MINIMUM OF ONE-HALF OF THE COMPENSATION MUST BE PAID TO LOCAL GOVERNMENT. FINALLY, THIS BILL PROVIDES FOR STATE AND LOCAL REGULATION OF THE TRANSPORTATION OF HAZARDOUS MATERIALS, INCLUDING THE DESIGNATION OF HIGHWAY ROUTES, IMPOSING RUSH HOUR CURFEWS, AND REQUIRING PERMITS, AS LONG AS THESE MEASURES DO NOT AFFECT INTERSTATE COMMERCE. THESE LAST FEW PROVISIONS ARE ALL RECOMMENDATIONS THE CITY OF LAS VEGAS HAS BEEN URGING FOR MONTHS.

THE FINAL BILL TO BE CONSIDERED AT THIS HEARING, 1007, IS FUNDAMENTALLY A MEASURE TO INCLUDE THE STATE OF OREGON IN REPOSITORY SELECTION ACTIVITIES, JUST AS IF IT WERE ONE OF THE THREE STATES ORIGINALLY CHOSEN FOR SITE CHARACTERIZATION. TO THE EXTENT THAT THE NUCLEAR WASTE PROCESS BECOMES MORE OPEN, WE FAVOR THIS BILL. HOWEVER, THE CITY OF LAS VEGAS HAS RESERVATIONS ABOUT WHETHER THE LANGUAGE INCLUDING THOSE STATES CONTIGUOUS TO AN UNDERGROUND AQUIFER INCLUDES NUMEROUS MIDWESTERN STATES FAR REMOVED FROM DEAF SMITH COUNTY, TEXAS. TO THE EXTENT THAT THIS OCCURRENCE WILL COMPLICATE A PROCESS ALREADY IN SERIOUS DISARRAY, THE CITY OF LAS VEGAS WOULD BE OPPOSED.

IN CONCLUSION, THE CITY OF LAS VEGAS STRONGLY FAVORS THE ADOPTION OF SENATE BILLS 1141, 1211, AND 1266, BUT HAS RESERVATIONS REGARDING SENATE BILL 1007.

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE, I WOULD LIKE TO THANK YOU FOR ALLOWING THE CITY OF LAS VEGAS TO PRESENT ITS VIEWS TODAY. THESE HEARINGS ARE AN INDICATION THAT CONGRESS VALUES THE THOUGHTS OF THOSE LOCAL GOVERNMENTS MOST DIRECTLY

INVOLVED AND CONCERNED WITH THE PROGRESS OF THE DEPARTMENT OF ENERGY'S SEARCH FOR THE BEST SITE AND THE BEST METHOD OF DISPOSING OF THE NATION'S RADIOACTIVE WASTE. WE APPRECIATE THIS CONSIDERATION AND LOOK FORWARD TO PRESENTING ADDITIONAL TESTIMONY, WHENEVER CONGRESS AGAIN CONSIDERS NUCLEAR WASTE ISSUES.

STATEMENT OF
NED R. MCWHERTER
GOVERNOR OF TENNESSEE

Presented to the
United States Senate
Committee on Energy and Natural Resources

The Honorable J. Bennett Johnston, Chairman

Washington, DC
July 16, 1987

The state of Tennessee rejects the proposal to develop a monitored retrievable storage facility at Oak Ridge, Tennessee. This is the position of both the Governor and the General Assembly. Tennessee has rejected the MRS proposal because the DOE has failed to demonstrate a need for this expensive project. The DOE proposal is not a viable solution to the problem of isolating nuclear waste from the human environment. Rather, it is a temporary solution inappropriate for waste materials that will remain dangerously radioactive for 10,000 years.

My "notice of disapproval" of the siting of an MRS in Tennessee (attached) was delivered to the Congress on May 28, 1987. The notice of disapproval of the General Assembly was submitted along with mine. These notices were submitted at this time out of an extreme abundance of caution given the significant legal uncertainty as to when such notice was timely. Our efforts to resolve this issue in federal court led to the conclusion that it was ultimately up to the Congress to determine the timeliness of any "notice of disapproval" which is issued.

The Nuclear Waste Policy Act provided the states with certain rights and with a chance for participation in structuring a national system for the final disposal of spent nuclear fuel. Tennessee has sought to protect and to exercise its rights under this law. Protecting our procedural rights has been a difficult task, due largely to the ambiguity of the language which was added to the Act to require a study of monitored retrievable storage. Nevertheless, Tennessee has participated by conducting a rigorous analysis of the MRS proposal. We have taken a constructive stance by proposing ways to improve the nuclear waste management system. We believe that a better system can be devised; one which results in less risk to the public and lower cost.

My comments address succinctly the perceived need for the MRS proposal, the proposal's cost, and the important ethical concerns in postponing the ultimate solution to this problem for another generation.

MRS IS NOT NEEDED

Much of the debate regarding the MRS proposal has focused upon the desired location of the facility. To some extent, the emotional atmosphere in which this debate has occurred has distracted attention from the more important question of whether the MRS is needed to ensure the success of the nuclear waste program. Studies undertaken in Tennessee and by the General Accounting Office in Washington raise serious questions about the prudence of this project.

The Tennessee studies indicate that the rod consolidation and storage functions proposed for the MRS can be accomplished effectively at the individual reactor sites. The DOE could encourage this alternative with two initiatives. The first would provide utilities with credits for fuel consolidation. The second would make available to utilities dual purpose casks suitable for storage at the reactors and adaptable for later transportation directly to the permanent geological repository.

The case for pursuing an alternative for on-site storage is strengthened by independent projections of the amount of spent fuel which nuclear utilities will generate. In fact, DOE recently adopted a number of the waste projection assumptions which the Tennessee study team used in 1985. Two years ago, DOE projections for spent fuel for the year 2000 were 20% higher than the Tennessee study. Today the difference is only 2 percent.

As waste volume projections drop, so do claims of avoided reactor storage costs attributable to MRS. DOE has testified that these savings would amount to $150 to $450 million assuming the first repository was developed on time. These anticipated savings, however, were based upon earlier waste volume projections that have since been discounted. The Congress should be aware that the actual cost savings likely will not exceed $100 million.

Substantially lower projections for spent fuel represent an extremely important issue in the debate over whether there exists a "crisis" of accumulated nuclear waste at our reactors. A number of reactors probably will decide to consolidate fuel rods at their sites to conserve available storage space. For some, this decision will come well before 1998, the most optimistic date for start-up of the first repository and the latest date projected for beginning MRS operations. Such early initiatives by the utilities are consistent with the DOE assumption that consolidated fuel is the desired waste form for repository emplacement. Congress should seek to encourage such beneficial actions by the utilities.

In recent years utilities and private support companies have been developing technology to consolidate fuel rods under water in the reactor storage pools. Some dry consolidation concepts also have been advanced. Several rod consolidation demonstrations have taken place. Others are planned by private firms anxious to prove that the process can be done safely. When the consolidated fuel is placed back into exiting storage pools, unit costs will be lower than for MRS fuel handling and storage.

For some reactors where further pool storage may not be appropriate, the fuel, either consolidated or not, can be kept at the reactor site in dry storage casks. The technology for such casks is nearing maturity. Such a cask already is licensed for use in West Germany. American utilities and the NRC are moving toward general licensing of dry storage casks at reactors without additional site-specific approvals.

Taken together, the advancing technologies in reactor consolidation and storage and diminished projections for the volume of spent fuel which will be generated suggest strongly that the primary functions for which MRS was conceived might well be handled routinely at reactors by the time an MRS could become operational. The motivation for such a policy would be nothing more than sound management by the utilities. With these options available to the utilities, the need for a temporary waste repository is no longer justifiable on grounds of cost or safety.

The task now should be to reinforce and reward the steps which have already been made toward sound management of America's nuclear waste. DOE could begin by developing a credit system for fuel consolidated at the reactors. Such a system of credits would recognize the benefits to the waste management system that result from the use of fewer casks and fewer shipments through the states. With this incentive, technology refinement for at-reactor consolidation could be moved forward at a quicker pace in response to DOE's efforts to organize and fund demonstrations.

DOE should accompany these efforts with a closer examination of cask designs that could serve both reactor storage and transportation functions. Such casks would reduce fuel handling and worker exposure. An appropriate family of dual purpose casks should be standardized by DOE for competitive manufacture.

In addition, DOE should pursue plans to move more of the spent fuel by rail than is currently proposed. The benefits of such a proposal would be substantial. With large rail casks fewer shipments would be necessary and costs and radiation exposure to the public could be reduced. To maximize use of this mode, DOE should become actively involved with the utilities in upgrading the cask handling and shipping capabilities of some of the reactors. DOE could help to coordinate shipping campaigns using dedicated trains. The non-standard shipping capabilities of the reactors should not be allowed to stand as a major constraint to creating an optimal waste management system for the nation. Tennessee's studies indicate that such improvements could reduce the number of cask-miles of shipping through the states down from 1.4 million annually with MRS, to 1.0 million with NO MRS and an improved transport plan.

MRS COSTS OVERSHADOW THE BENEFITS

Determining the cost of MRS to the Congress and to Tennessee has been extremely difficult. Life cycle system cost increases attributable to MRS climbed from $2.0 billion to $2.6 billion between December 1985 and April 1986. As the General Accounting Office has revealed, even the latter figure did not include a lengthy list of expensive items. One such item, likely compensation to the impacted state and community, could easily reach $1 billion.

Apart from costs associated with the MRS construction, operating cost estimates contained in the proposal recently sent to Congress have been reduced dramatically, and warrant critical examination. Based upon highly questionable assumptions, estimates of total system life cycle cost increases due to MRS have been recently reduced from $2.6 to $1.6 billion. The billion dollar reduction received insufficient documentation in the proposal, was not explained prior to the proposal being sent to Congress and should, therefore, be highly suspect.

The projected economic benefits appear to fall far short of justifying the enormous cost of the MRS. The most favorable scenario of benefits, which includes a repository in Washington, could produce only $650 million. Benefits ratios for all other scenarios are far lower. The question before the Congress is whether $3 billion should be appropriated for an MRS proposal of dubious economic benefit. An issue of this magnitude should be resolved on the basis of sound data that is not subject to whims of arbitrary change.

THE INTENT OF THE NUCLEAR WASTE POLICY ACT

We urge this committee to take a hard look at the need for this project and the costs involved. The debate should also include an assessment of the underlying congressional purpose of the Nuclear Waste Policy Act. The past two years have been characterized by an unnecessary sense of urgency regarding the development of an MRS. DOE's insistence in late 1985 that the proposal be acted upon immediately by the Congress is evidence of this generated sense of urgency. The MRS proposal was expedited at that time despite requests by Tennessee officials for adequate time to allow citizens and the state review team to study the proposal and develop comprehensive comments to be meaningfully incorporated into the proposal to Congress. Only litigation initiated by the state's Attorney General slowed the process temporarily. Yet almost two years after the litigation was initiated, the state's questions and concerns remain.

Other recent actions have served to undermine the congressional purpose of the Nuclear Waste Policy Act. The proposed five-year "extension" of the date for a first repository, and the proposed "postponement" of site-specific work on a second repository have created unwarranted pressure to proceed quickly with the MRS project. Recent emphasis on an unauthorized MRS and the proposed schedule "extension" to develop the authorized portions of the system constitute a distortion of the intent of the Nuclear Waste Policy Act.

Implementation of the Act seems to be in disarray. There are many different concepts on what can be done.

Some new ideas have recently been presented in the form of legislation which represent radical departures from the Nuclear Waste Policy Act. Those which seek extensive above-ground storage systems are most objectionable because of the shift of the final disposal burden to future generations.

Senate Bill 839 provides an incentive system which might be helpful in some respects, but this bill suffers from so many flaws that we must object. Incentives might be appropriate for a facility such as an MRS which could be sited in a wide range of geologic settings. Incentives may not be appropriate for siting a repository unless it can be assured that only candidates with technically adequate sites may apply.

Beyond the concept of incentives, S839 seeks to authorize an MRS without further examination of the need for such a facility and without regard to the costs of the project versus the benefits. Clearly, a determination of the need for such a project should proceed the offer of incentives for a state to host it.

S839 seeks to strip away the protections for the host states that were wisely included in the original Nuclear Waste Policy Act. It seems doubtful that the states will be willing to trade these safeguards for the monetary incentives offered.

A long-term solution for nuclear waste is an issue of the highest priority. The Congress recognized this when it enacted the Nuclear Waste Policy Act. The fundamental principle was then, and still should be, that solutions for the problem should not be deferred to another generation. At issue today is whether the proposal to store nuclear waste in a surface facility would serve only to delay final isolation of the waste from the human environment.

CONCLUSION

The state of Tennessee is deeply concerned about events of the past two years regarding implementation of the Nuclear Waste Policy Act. During this period there has been an ominous drift away from the Act's original intent, along with a false sense of urgency about the need for a temporary waste storage facility. This change is evident in the recently proposed Mission Plan Amendments which move MRS to the forefront to receive spent fuel at the same time a permanent solution is delayed. This DOE proposal is accompanied by statements from some utilities and some nuclear industry representatives calling for "unrestricted use" of the MRS. They seek to drop the schedule linkage to repository development proposed by DOE and call for lifting the cap on MRS storage capacity. Such actions point toward a mind-set that, in effect, would accept a "temporary" solution to a serious national problem with environmental implications for the next 10,000 years. The question before the Congress is whether we are prepared to take a stand now and reject the notion that we can pass this problem on to our children and grandchildren. Put simply, Tennessee wants no part of a de facto above-ground repository

The people of our state believe that the shortcomings of this proposal are not limited to the practical considerations of safety, cost, and technological feasibility. They also include issues that reach to the heart of the relationship between the states and the federal government. After two years of examining the proposal, the people of Tennessee and our state government are unconvinced that the proposed MRS facility is either economically or environmentally sound. Moreover, we do not believe that the process of designing and locating the facility has been conducted in good faith. We think the Congress intended that a potential MRS host state would have the same procedural rights as the states which are potential candidates for hosting a permanent repository site. Tennessee has not been afforded these rights.

On behalf of the people of Tennessee, I implore the Congress to heed the concerns expressed in this testimony. The impacts of your decisions upon the lives of the people in Tennessee could be profound and irrevocable. In the name of reason, and in the name of fairness, I urge that you not make this decision indifferently.

State of Tennessee

NED McWHERTER
GOVERNOR

May 27, 1987

Honorable John C. Stennis
President *pro tempore* of the
United States Senate
Room 205
Russell Senate Office Building
Washington, D.C. 20515

Dear Senator Stennis:

Please accept this letter as my formal notice of disapproval in accordance with 42 U.S.C. § 10161(h) and § 10136(b) of the Nuclear Waste Policy Act of 1982, P.L. 97-425, 42 U.S.C. §§ 10101, *et seq.*, of the Secretary of the Department of Energy's designation of a site on the Clinch River of the Roane County portion of Oak Ridge, Tennessee, for construction of a Monitored Retrievable Storage facility. This site is the location of the once-proposed Clinch River Breeder Reactor. I am also giving notice of my disapproval of two alternative sites designated by the Secretary, one on the Oak Ridge Federal Reservation and the other on Federal Government land near Hartsville, Tennessee. The Secretary has designated these sites in plans submitted to Congress on or about March 30, 1987, in accordance with 42 U.S.C. § 10161.

The substantive reasons supporting this notice are set forth in a report prepared by the Environmental Policy Group of the Tennessee Department of Health and Environment. A copy of the report accompanies this notice. The report should be considered my formal statement under 42 U.S.C. § 10136(b)(2) explaining the reasons for which I am issuing this notice.

I am filing the notice now out of an extreme abundance of caution given the significant legal uncertainty as to when this notice is timely. I recognize that the Department of Energy strongly insists that a notice of disapproval from me is not timely until after Congress authorizes an MRS in Tennessee. I attempted to resolve this question in a lawsuit filed by the Tennessee Attorney General's Office on my behalf in the United States District Court for the District of

Columbia. On May 26, 1987, the Court ruled that the question of timeliness of the notice of disapproval was not an appropriate issue for the Courts to resolve. (A copy of the Court's decision is attached hereto). The Court's opinion does, however, clearly indicate that it is ultimately up to the Congress of the United States to determine the timeliness of any notice of disapproval which I issue. In the meantime prior to any such determination, I am compelled to preserve what rights I may have under the law as Governor of Tennessee and file the notice at this time for such consideration as Congress deems appropriate.

Sincerely yours,

NED McWHERTER
Governor

NM:dmm
Enclosure

THE 2nd KAIF/KNS JOINT ANNUAL CONFERENCE

Final paper

SPENT NUCLEAR FUEL MANAGEMENT
OPTIMIZING THE FUEL CYCLE

J.C. GUAIS - COGEMA/FRANCE

M. LUNG - SGN
A. BARTHOUX - ANDRA

INTRODUCTION

After a long and continuous effort of 25 years and more in the fields of research, development and industrialisation, France today masters the back-end of the fuel cycle, providing a complete and rational way of managing the spent fuel from reactors.

All the operations for closing the fuel cyle are successfully achieved on the industrial scale by COGEMA and its partners, mainly SGN with its back-end engineering capabilities, ANDRA, the National Agency for Waste Management, and other French industries.

These operations include : transportation of spent fuels, unloading and storage, reprocessing, waste conditioning, long-term disposal, and recycling of fissile materials, both uranium and plutonium.
Now that these operations are technically, industrially and commercially mastered, we believe that reprocessing and recycling offer the optimum solution for a safe and economic fuel cycle, keeping open the future improvements of the nuclear industry, and hence contributing to the necessary development of nuclear energy.

1 - SPENT FUEL TRANSPORTATION

COGEMA has accumulated a unique industrial experience in spent fuel handling and transportation since 1975. More than 1700 transportation casks, i.e. over 5000 tonnes of spent fuel have been safely shipped to La Hague from 60 LWR reactors of Europe and Japan.
COGEMA has a proper team for managing the nuclear material transportations, and relies upon well-known international companies :

- Transnucleaire (COGEMA 25 %) with its offices and subsidiaries in the USA, Japan and Europe ;
- Nuclear Transport Limited, a subsidiary of Transnucleaire for the European shipments ;
- Pacific Nuclear Transport Limited, for shipments between Japan and Europe.

COGEMA uses dry casks developed by the Transnucleaire group for transporting non-encapsulated spent fuel.
Let us mention the TN 12 cask, in operation since 1980, which contains 12 PWR fuel elements, with a thermal release of 85 KW, corresponding to a discharge burn-up of 35000 MWd/t and a cooling period ATR of 240 days. This cask can alternately hold 32 BWR fuel elements.

For sea transportation, the quantities involved are of course very limited and the ships are small (3000 tonnes for intercontinental travels, 2000 tonnes for shipments between European countries). But these ships have sophisticated equipments in order to comply with very stringent requirements : an exceptional reliability, the protection of the crew from radiations, specific instrumentions and communication systems.
For ground transportation, COGEMA uses preferably rail, with special rail cars of 150 tons payload. 30 such wagons are operated in France and the European countries. Road trucks are used only between the customer's reactor and the closest railroad station or sea port terminal. At the other end, there is only a few miles of road transportation between the Valognes terminal and the La Hague reception yard.

In term of regulations, France, as practically all other nuclear countries, strictly adheres to the rules of IAEA and those of other international organizations : OTI, IATA, which in turn are derived from IAEA regulations.

2 - SPENT FUEL RECEPTION, UNLOADING AND STORAGE

Centralized spent fuel storage has been performed in France since 1957 at Marcoule, and a large experience of fuel reception and storage has been acquired progressively with all sorts of fuels : gas graphite, LWR, FBR and MTR type fuels.

This way, many sorts of fuel reception and storage have been tested :

- fuel reception without casks with hydraulic transportation ;
- fuel reception in wet or dry casks with unloading underwater or in-dry cells ;
- fuel storage underwater in racks or baskets ;
- fuel storage in dry vaults ;
- fuel storage in dry casks.

We will describe here two cases of spent fuel storage developed by SGN, the COGEMA subsidiary for engineering : one is a buffer storage associated with the large reprocessing complex of La Hague, the other serves as interim storage (30 years or more) of diverse fuels prior to a decision for reprocessing or disposal.

2.1 La Hague spent fuel buffer storage

This complex is the largest in the world, with a reception capacity of 3 casks per day, a storage capacity up to 10,000 tons of LWR fuel, a cask maintenance facility of one to two casks per week. It is designed for the nominal reprocessing capacity of 1600 tons/year.
We can distinguish four functions in that large system :

- The cask storage yard called AML is in itself a free buffer storage in casks, with a possible fuel capacity of about 200 tons. The residence time of the fuel, however, is limited here to a few days, maximum a few months, due to cask turnover.

  The casks arriving on trucks are unloaded on heavy lorries on rails, which are easily transferred to the cask unloading facilities.

- These cask unloading plants are of two types : an underwater unloading shop called NPH, and a dry unloading shop called TO.

  At NPH, such "conventional" type of unloading is convenient for non-standardized dry or wet casks.
  Precautions must be taken to avoid contaminating the unloading pool water when opening the casks.

Hence a special cask circuit with appropriate filtration is designed to purify the cask water, or the water introduced in the cask to cool the fuel before the opening. Also the cask outside will be protected from surface contamination of the fins by a appropriate skirt. At this moment, about 1,600 tons of LWR fuel have been handled.

All these operations can hardly be done remotely, so that, although NPH is a very flexible facility, the need was felt for a totally remote cask unloading.

- This is achieved in the new dry unloading facility of La Hague called T0, where the casks are set vertically on a trolley and adapted underneath a large handling dry cell with a special contamination tight coupling device operated from inside the cell. A crane lifts the fuel elements one by one out of the cask, dips them in a special quench tank where the fuel elements are at the same time colled and controlled for the integrity of the cladding.

  Such an industrial facility, besides being totally remotely run, presents the advantage of having the cask always free of contamination on its outside. The T0 facility has kept its promise since its start-up in September 1986 and truly represents a breakthrough in cask and fuel handling.

- The four large storage pools have a total storage capacity of 10,000 tons. Pond E, the largest, has a 4,000 tons capacity. They are basket-type pools, not rack-type pools. This represents a saving in water depth and in total water volume, since the baskets are of compact type.

  The pools present several interesting features, including a fully radiographied SS-lining, special ventilation, in-pool heat and ion-exchangers called Nymphea, for added safety and cost savings. The pools are seismic-proof and mounted on special shock-absorbers. Basket setting and fuel retrieval are done automatically by special pole cranes.

- The casks, after a certain number of rotations, need to be cleaned inside and maintained : change or repair of the cask internals, change of the gaskets, repair of damaged fins, etc.

  The casks are first decontaminated and cleaned inside by means of pressure water in a hot cell called AEC, to which the casks are coupled vertically. When the contact dose is low enough to permit contact repairs, the casks are maintained in a more conventional shop called AMEC, where they are completely overhauled.

This description shows that a large reprocessing plant needs extensive facilities for fuel handling and storage. Those recently put in service at La Hague permit this with great safety, easiness, and for a reasonable cost, since per kg of fuel stored, the investment is of the order of 40-50 dollars.

2.2 A quite different facility is under construction at Cadarache, called CASCAD. It is a dry vault storage facility for rather long cooled fuels from different origins which the CEA wants to gather in our storage place for better accountability.

The fuels are extracted remotely from the casks and placed in tight stainless-steel boxes for better containment, under inert gas for long conservation. These boxes are stacked in vertical steel lined pits in a specially-built concrete vault where they are cooled by draft-convection air, using the same principle as experienced in the glass waste container storage vaults of AVM at Marcoule, and soon of AVH at La Hague. A similar system is also being used for boxed bundles of FBR Phenix pins at Marcoule.

Such a system, called CASCAD, is now under construction at Cadarache. The first storage should be put in operation in 1939.

In such dry vaults, care must be exercised to avoid overheating of the core of the fuel elements, which should be kept below about 450° C.

In our view, such a vault facility is convenient for long-term storage, although retrievability of the fuel is less easy than in a pool storage. The investment cost is higher than for pools but the operation cost being lower, the overall storage cost for modules of about 1,000 tons for more than 10 year storage may be in favour of the vault under certain conditions.

3 - REPROCESSING OPERATIONS

By the end of 1986, the La Hague UP2-400 plant had reprocessed more than 1600 tonnes of LWR fuel. The facility is presently running smoothly at its nominal 40 tonnes/month capacity.
Figure 1 shows the cumulative tonnage reprocessed at La Hague by the end of 1986.

Production and productivity of reprocessing and waste management plants cannot be achieved at the expense of high safety standards. In the absence of any significant incident, safety performance can be evaluated by analyzing personnel exposure statistics. The annual average individual dose rate of La Hague personnel decreased from a maximum of 509 mrem in 1975 to 156 mrem in 1986, compared to a maximum allowable dose rate of 5000 mrems.

The figure 2 shows the evolution of the average individual dose at La Hague.

The specific dose rate, which is the ratio of the collective dose rate to the amount of electricity produced by the reprocessed fuel, decreased also to a level of 0.08 man rem/MWe year in 1986. The corresponding figure for uranium mining is 0.25 man rem/MWe year and light water reactor operation generates specific doses of at least the same order of magnitude as uranium mining.

The figure 3 shows the specific dose rate evolution at the reprocessing plant.

Under construction are the facility UP3 scheduled for by the beginning of 1989 and the facility UP2 800 which is an extension and modernization of the UP2 400 plant and will be on stream in 1992. The total capacity of La Hague plant will then be 1600 tonnes/year.
SGN is the architect-engineer for the whole realization, coordinating the work of several other engineering companies.
The financing of UP2 is shared between COGEMA and EDF while UP3 is totally financed by foreign customers, to which the first productions of the plant will be dedicated.

These two new plants have integrated in their design the experience of a number of pilot, prototype or industrial reprocessing plants, such as UP1 in Marcoule, Eurochemic in Belgium, Tokai-Mura in Japan, UP2-400 at La Hague, etc.

Two major objectives have been sought in the design of these two large new plant : safety and reliability.

The safety of operation is achieved by choosing a safe process, safe procedures, reasonable margins of safety, and many interlocks and automatisms to prevent manual errors in the different unit operations such as fuel handling, shearing, dissolution, extraction and purification steps. Remote operation and remote maintenance also limit the dose rate to the operating personnel considerably below the permissible dose.

The reliability is achieved by using well-proven processes, incorporating many improvements due to experience. All new parts have been extensively tested in pilot plants at the CEA. For those very active parts which need mechanical maintenance, it will be possible to dismount them and replace them remotely by means of remote cranes and replacement casks. The cranes themselves can be repaired easily as they are made up of modular interchangeable parts. Smaller equipment such as pumps, valves, ejectors, etc, can be changed easily by means of tight casks, called MERC. Moreover, some production lines have been doubled, whenever necessary.

4 - WASTE PROCESSING AND CONDITIONING

Waste processing in the back-end of the fuel cycle is the key to a successful operation. Two main objectives are aimed at when reprocessing : fuel recycle and safety. We consider that a well-managed waste processing and disposal downwards of a reprocessing plant increases the safety of the nuclear fuel cycle, compared to long-term storage of unreprocessed fuel elements.

At La Hague, dissolution offgases, tritium, krypton and iodine are disposed of according to their toxicity. Krypton and tritium are released to the environment, in the atmosphere and in the sea, respectively, where dilution offers the best safe disposal way. Iodine is trapped in special offgas systems and iodine compounds are embedded in concrete for disposal.
The low-level effluents are concentrated and embedded in bitumen or concrete for disposal in above ground, medium-term repositories.
All the high level effluents and long-lived lanthanides or transuranics are gathered. Those account for more than 99 % of the total activity handled in the incoming spent fuel elements. They come from the extraction raffinates after dissolution, spent solvent cleanup, dissolution insolubles or fines, etc.
All these compounds are concentrated and incorporated into a borosilicate glass. Extensive research, in France especially, has led to the conclusion that this glass form is highly insoluble in all sorts of natural ground waters and that the glass blocks obtained, properly poured in all welded stainless-steel containers, can be safely disposed of in a man-made underground cavern with appropriate overpack and natural absorbent around each glass package.
In the meantime, the glass canisters are let to cool due to activity decrease, in concrete engineered storages similar to those described above for CASCAD. At Marcoule, the storage now contains about 1,500 glass canisters which have been elaborated since 1978. At La Hague, the storage will contain 2,500 canisters, or the production of UP3 and UP2 800 from 5 years. Other storage modules can be built. After the 10 to 30 years cooling period, the canisters will be sent to the final repository.

The vitrification technology presently installed at La Hague (AVH) is extrapolated from the AVM process developed since 20 years at Marcoule, with extensive R and D conducted by CEA, including tests and fullsize operation of inactive pilot plants (see figure 4).

AVM and AVH are characterized by a two-step continuous process : a calcination of the wastes to gradually obtain the oxides which in our view is a safe manner to avoid any burst or overpressures with waste nitrates. This is done in a rotating calciner. Oxides are mixed continuously with the appropriate glass frit and melted in an induction-heated metallic melter which is emptied twice a day into 150 liter stainless-steel canisters. These, after cooling, are automatically, welded and decontaminated, before being stored in the above-mentioned dry wells.

The whole operation is done completely remotely in hot cells. The maitenance and replacement of spare parts is done by means of special connectors (jumpers) and a crane and master-slave mainpulators.

The process allows a very good life of the equipment : a calciner life is more than 20,000 hours, a melter, 8,000 hours, etc. Any replacement of such parts can be done within a few days. The downtime of the AVM Plant is less than 25 %, and the equipment, being all metallic, can be cut into pieces which can be put in the same canisters as the glass ones. About 5 % of maintenance wastes have been obtained after 8 years of operation.

Six such vitrification lines are being installed at La Hague, three for UP3 and three for UP2 800. The latter unit, called R7, will start operation in 1988, the other in 1991. BNFL has chosen this system for the Sellafield plants, where two similar vitrification lines are being completed.

From an environmental point of view, we consider that such systems today are safer and more comprehensive that any other industrial waste management system where the quality assurance procedures are less drastic.

5 - WASTE LONG-TERM MANAGEMENT

Long-term industrial management of radioactive waste in France is carried out by the Agence Nationale pour la Gestion des Dechets Radioactifs (ANDRA) created in 1979 within C.E.A. by an interministerial order. ANDRA is responsible mainly for design, siting, construction and operation of the disposal centers for every kind of radioactive waste produced in the country. Among all its activities, one of the most important is definition and control of the required quality of waste packages. Yet the final goal of ANDRA is essentially disposal of radioactive waste. As far as disposal is concerned it is usual to classify waste in two main categories.

- The first category includes all the so-called "short lived" waste containing mainly radioactive substances having half-life less than 30 years (beta-gamma emitters) and, in few cases, a very small amount of long half-life substances. Most of these wastes, such as, for instance, resins and filters for purifing cooling water circuits, are produced by operating nuclear reactors. The remainder comes from normal operation or maintenance of fuel cycle plants, large research laboratories and various users of radioactive sources like hospitals, universities, etc.
  First category waste account for nearly 95 % of the total amount of radioactive waste but only for 1 % of the total activity.
  In France, the technical option for final disposal is near surface repositories.

- The second category includes the waste containing a significant amount of long-lived substances such as transuranic nuclides. The radioactive substances in this category come from irradiated reactor fuel rods, whether the fuel rods are reprocessed or not. When spent fuel is reprocessed, it is possible to identify two subcategories :
  - . alpha waste, from the name of their principal long lived nuclides. These vastes a low or medium activity level ;
  - . vitrified waste, from the same of their conditioning process, containing in addition to long-lived nuclides a large amount of fission products which produce a fairly important amount of heat which decrease along the time according to the half-life of cesium and strontium (30 years).

  In France, the technical option for the final disposal is continental, deep under ground repository.

5.1 Shallow land disposal

ANDRA has developped an original concept of shallow land disposal often called "earth mounded concrete structures" which provides a full isolation of the waste from environment until radioactivity has decreased to a negligible level. This concept is implemented at "Centre de la Manche", the first repository, and has been chosen for the future disposal center.

MANCHE CENTER

France's first shallow land repository - the Manche Center - has been in operation for 17 years on 12 hectares at the tip of the Cherbourg peninsula. At the Center, short-lived wastes are disposed of in concrete structures : monliths for medium level wastes ; tumuli for low-level wastes. These structures are then filled with gravel and covered with a watertight layer of clay and top soil.

In monoliths are deposited wastes whose packaging does not provide adequate isolation for radionuclides. To build a structure to accomodate the concrete monoliths, a wide pit is first excavated and the bottom concreted. A catchment system is provided to collect any runoff water entering during construction. The pit is subdivided by panels into compartments, into which a crane then lowers the packages. They are laid in successive layers ; concrete is then poured in, completely embedding the packages. Reinforcing steel is placed on the last layer of packages. The compartment is then completely filled with concrete, thus producing a concrete monolith.
In tumuli may be accepted two kinds of wastes : those whose activity is low enough to be considered intrinsically safe, and those whose packaging is safe enough to ensure containment of its own as good as that given by monoliths. Blocks are stacked to a maximum of four levels, or about 6 meters. The blocks are placed along the perimeter of the area and in rows inside the area, thus building the structural framework of the tumulus. Along the periphery, the blocks are stacked in a stepped arrangement to give the final tumulus the shape of a gently sloping knoll. Metal drums are disposed of by category inside the compartment formed by the rows of blocks. The blocks and the drums bear an identification number that serves to locate them inside the tumulus. Nearly 10 000 m^3 of packages can thus be disposed of in an area of 3 000 m^2.

When disposal of the concrete blocks and metal drums is complete, backfilling material is poured over the entire pile to fill all the gaps between the packages and guarantee the stability of the tumulus. The disposal

tumulus is then covered with a thick layer of impermeable clay and surrounded by a catchment system to collect rain water flowing over that clay. The clay is then covered with top soil and plants to hold that soil firm.
Each package disposed of in the repository is recorded. The main characteristics and the final location data are stored in three different places for several hundred years, corresponding to the survey period. A permanent inventory of the activity contained in the wastes is regularly updated.
The Manche Center has a total capacity of about 400 000 m^3 of waste. According to present rate of deliveries it will be filled in the beginning of the 90's. Thus, after examination of ANDRA proposals, the French Department of Energy ordered to create a new repository.

SECOND SHALLOW LAND REPOSITORY

After having set up a national inventory of possible sites, ANDRA was allowed to start a site prospection program in September 1984. After one year of hydrogeological investigations by geophysical methods and drilings on about 30 000 hectares scattered in three regions, it has been possible to select one candidate site located at about 150 kilometers south-east of Paris.

This option was announced in October 1985. After one additional investigation, the licensing procedure for the future repository has been launched in July 1986. This procedure includes a project review by many local and governmental bodies, an examination by a special safety experts group and a public inquiry. It will last one year. If all the agreements are obtained, the authorization for construction should be given mid 1987. Then construction will last about 30 months and the first packages could be received at the end of 1990.
This center will have a total capacity of about 1 000 000 m^3 and it will be in operation for, at least, 30 years. The technical options chosen for construction and operation are very similar to those adopted at Manche Center.

5.2 Deep underground disposal

Research on treatment and conditioning of second category radioactive waste started in France more than 25 years ago. Today conditioning technology is industrially implemented. High level waste are and will be vitrified, transuranic waste are and will be embedded in concrete or bitumen. The problem which remains to solve for this second category is the industrial disposal as it exists for the first category at Manche Center.

Here again, the technical option is isolation from environment deep underground in a selected geological setting which can provide long term stability (over 10 000 years) and very impervious rock type.
Thus, the choice of a site is a key issue for technical reasons and with respect to its sociopolitical impact.

National Inventory - For these reasons and considering the broad variety of possible host rocks in France, it has been decided to investigate the possibility of creating an underground repository in defference rock types : sedimentary rock such as clay or salt and hard rock such as granite or schists. All of them show some advantages and it has been proven in different countries that a safe repository can be constructed in each type. But fo all of them, the remaining task is to provide site specific demonstrations either of technical feasibility and stability during the operational period or of the tightness of the backfilling and/or the surrounding geosphere over a long period of time. In every case, even if all these demonstrations were made, the whole system remains to be optimized.

The possibility of having suitable sites in several host rocks provides an interesting flexibility for the final choice. The first step of the site selection process was to compile a national inventory of the possible sites, based on criteria among which the most important were : long-term stability, and favorable hydrogeologic sites with very low permeability and good physico-chemical properties such as nuclide retention. The national inventory was completed at the end of 1983. About 30 zones covering the four main typical geologic settings : clay, outcropping granite, schists, and salt, were identified as possible locations for a future repository. In some cases a combination of layers of the different materials improves the isolation capacity of the site.
Among the 30 zones, a preselection has been made of the most attractive ones on which further investigations have to be carried out.

Confirmation of the preselection - As soon as consultation with local authorities and local representatives permits, the second step will be to start field investigations to confirm the choice of the preselected sites and to meet the Government's requirement that a candidate location be nominated for the Undergroun Site Validation Laboratory (USVL) by the end of 1989. This second phase has started in February 1987 on four zones covering all the different typical kinds of host rock.

Site Validation - After a candidate site has been selected at the end of the previous phase, construction of the Underground Site Validation Lab will start. The lab will be the main tool to complete the site selection process by validating the site. Validation means that, with the data collected during this phase, it will be possible to demonstrate the technical feasibility and the economics of the repository, and to prepare a preliminary safety impact report to show that the future repository's consequences for the environment are acceptable.
To achieve this, it is necessary to explore in depth the whole volume of rock involved in the repository construction and to carry out in-situ experiments to confirm thermal and mechanical behavior of the host rock and to evaluate and modelize the isolation capability of the whole system of barriers, including backfilling material and the different layers of the geosphere.
Construction of the USVL will probably spread over two years and its implementation will last between two and three years.

Construction of the repository - The first priority in building the deep underground repository is to start with the TRU waste facility, because there is a real economic incentive to dispose of such wastes as soon as possible. The heat they produce is low and does not necessitate a decay period. A series of configurations have been studied to evaluate the thermal evolution of the repository as a function of the size, the shape and the distance between the galleries. In every type of host rock, even for cladding hulls, which produce the most important heat output, it is possible to find a geometry wich allows an early diposal of this waste. Erection of the surface buildings, transformation of the access to the laboratory into large shafts to allow the handling of waste packages, and construction of the disposal galleries will last about four years. Then the first waste packages could be accepted for final disposal around year 2000.

As far as HLW is concerned, the heat output makes necessary to keep them for decay for several decades in air-cooled storage surface facilities. The cooling time depends on the type of hos rock, but it appears that 20 to 30 years of decay will allow the total cost of management to be reduced, taking into account the cost of the storage facilities and the cost of the final repository. It seems very likely that no high-level waste will be disposed of in France before the years 2000 to 2010.

6 - PLUTONIUM RECYCLING

The French experience in plutonium fuels dates back to 1962. The CEA/COGEMA Cadarache fabrication facility supplied fuel for the fast breeder reactors RAPSODIE, PHENIX and recently SUPER-PHENIX the 1200 MWe FBR at Creys-Malville.
An extension of this facility for thermal MOX fuel is in the commissioning phase.

COGEMA is associated with BELGONUCLEAIRE (Belgium) in a joint venture, the COMMOX Company, which sells MOX fuel rods. Such MOX products have been delivered so far to 16 customers in 11 differents countries. BELGONUCLEAIRE has a 25 years experience in plutonium recycling both for fast breeder and thermal reactors. Its Dessel located plant fabricated the first MOX assembly in 1962. This plant has a present capacity of 35 t/year.
Both partners in the COMMOX venture have plans for production capacity extension : a 100 t/year plant called MELOX will start production in France in the early nineties and a following unit, DEMOX, will further increases the Dessel capacity.

Pressurized-water reactors reloads are currently designed and manufactured by FRAGEMA which incorporates in the bundles the mixed-oxide rods supplied by COMMOX.
Two nuclear units in France are to be loaded in 1987 with MOX assemblies and EDF has plans to introduce such fuel materials in 12 units in the frame of a progressive program.

The same policy has been adopted by other utilities in EUROPE, namely in Federal Republic of Germany and Switzerland were MOX reloading has become a reality.

7 - URANIUM RECYCLING

Recycling Uranium obtained from reprocessing implies reenrichment of this material in order to raise its U235 assay from the residual value around 1 % to the usual 3-4 % range requested by LWR.

Prior to reenrichment, the conversion of uranyl nitrate produced by the reprocessing plant has to be carried out in special dedicated facilities, due to radio-chemical activity of the product.
The conversion into UF6 started at COMURHEX ten years ago and the present cumulative amount converted at the COMURHEX Pierrelatte plant is more than 1500 tonnes, the uranyl nitrate coming from COGEMA La Hague as well as from the DWK facilities in the Federal Republic of Germany.
In addition a COGEMA facility, on the Tricastin site, is carrying out the transformation of uranyl nitrate into oxides for convenient interim storage before further recycling through fluoration and reenrichment.

Since 1986, COGEMA and COMURHEX are associated in the UREP joint venture to offer those services between reprocessing and reenrichment, thus closing the uranium loop. New large conversion facilities consistent with the La Hague plant output are planned for the early nineties.

The enrichment of reprocessed uranium has then to be carried out with the view of limiting the mixing of this material with fresh feed. Particular operating modes of the enrichment plants have thus to be adopted : either a dedicated production line or a batch-operation program, according to the specific features of the enrichment processes. In large gaseous diffusion plant we use the later operating mode. By the end of the century, advanced enrichment technology using laser isotopic separation process will be available and will offer a great advantage by selecting more efficiently the U235 fissile isotope.

CONCLUSION

The rationale for closing the fuel cycle

In the last years we have seen many publications on the subjects of fuel cycle economics and overall fuel management. Some studies are devoted to the comparative economics of closed fuel cycle (i.e. reprocessing and recycling) versus once-through cycle (considering the spent fuel as a waste to be disposed of permanently). A most complete report on this subject was issued in 1985 by OECD/NEA, offering a comprehensive description of the cost calculation method for both closed and open cycles.

Using this methodology we recently performed an in-house comparison, feeding the model with our industrial results and costs.
A major parameter governing the economic assessment of the closed fuel cycle is obviously the reprocessing cost and its future evolution.
In this field, COGEMA can now announce a decreasing trend for the cost of industrial reprocessing and associated operations. The smooth operation of the present UP2-400 plant is a strong basis for predicting better availability factors than (prudently) anticipated, for the new plants UP3 and UP2-800. Moreover, the contractual arrangements made for the UP3 plant will leave some available capacities after the base-load period, that is from the year 2000 onwards. At that time the plant investment cost repayment will be finished and despite maintenance and refurbishing expenses, the result will be a significant reduction in the reprocessing cost for this period.
When we take into account this cost evolution, the overall fuel cycle cost appears to be clearly lower for the reprocessing/recycling option than for the once-through route.

Moreover we believe that for a utility, the decision to choose the open or closed cycle is also based on other criteria besides cost assessment, such as nuclear development strategy, national energy policy, risks analysis, environmental issues, and public acceptance.
For each of these criteria, our conclusion is that the reprocessing/recycling option offers a clear advantage. For instance, such choice leaves open the future development of FBRs, a necessary long-term policy for nuclear energy development. Another important strategic attitude is to consider spent fuel as an available domestic resource instead of a waste.
In terms of safety, we believe that the separation of recyclable materials from HLM and MLW and LLW, for proper conditioning and long-term management, is the rational way for a safe and secure long-term disposal.

Finally in terms of the responsibility our generation has towards our environment and our future, it is mandatory that we leave an acceptable, manageable, solution for the next generations, instead of letting them handle our problems.

=-=-=-=-=-=-=-=

FIGURE 1

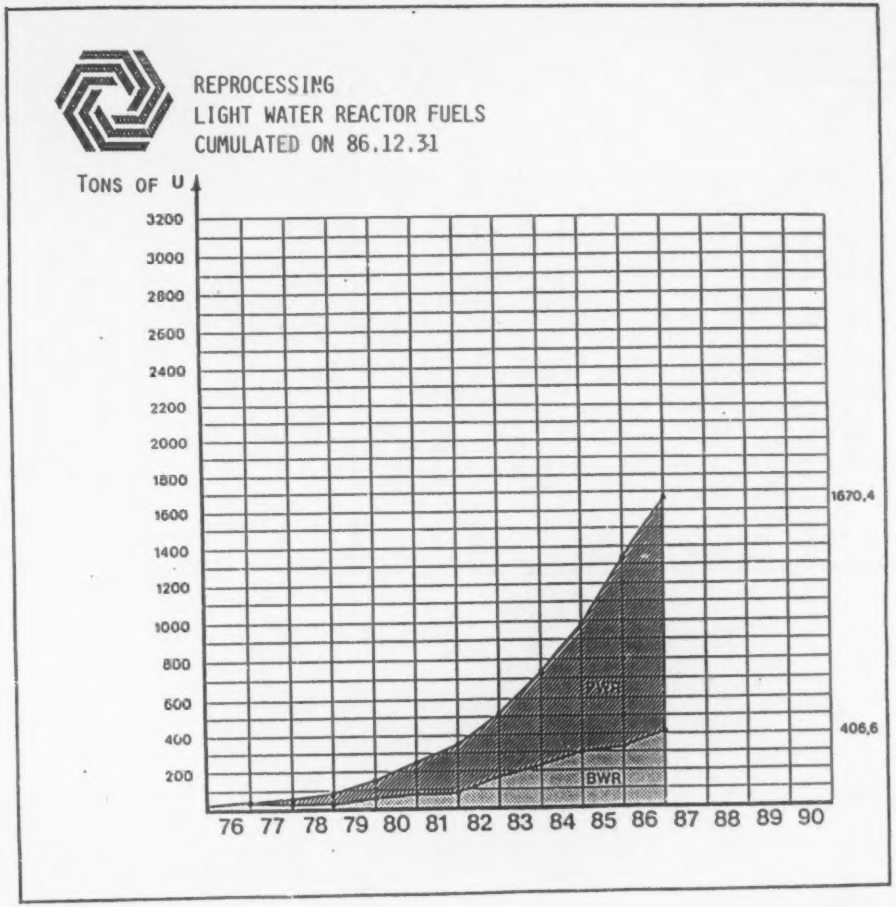

REPROCESSING
LIGHT WATER REACTOR FUELS
CUMULATED ON 86.12.31
TONS OF U
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90
PWR
BWR
1670,4
406,6

FIGURE 2

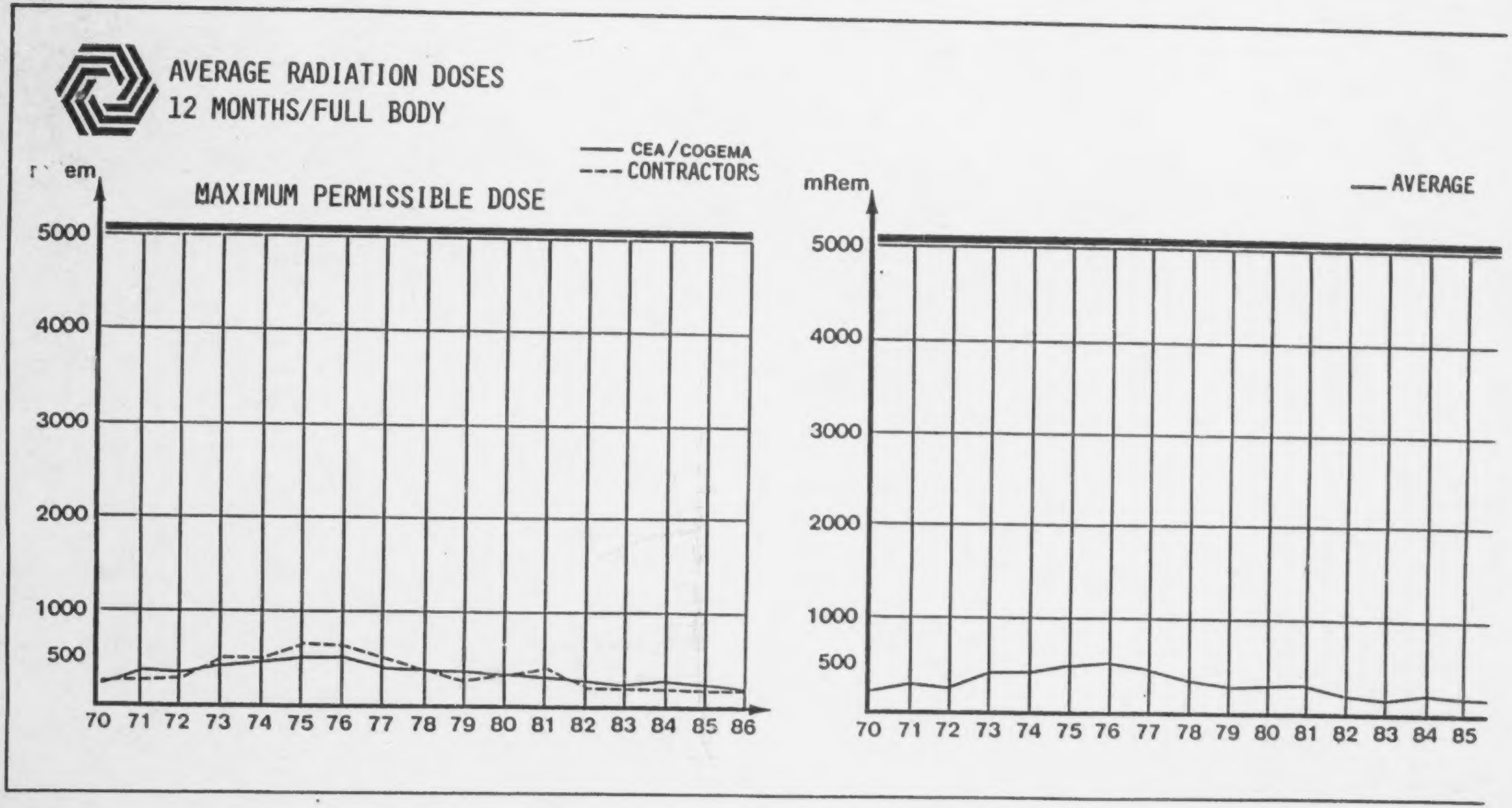
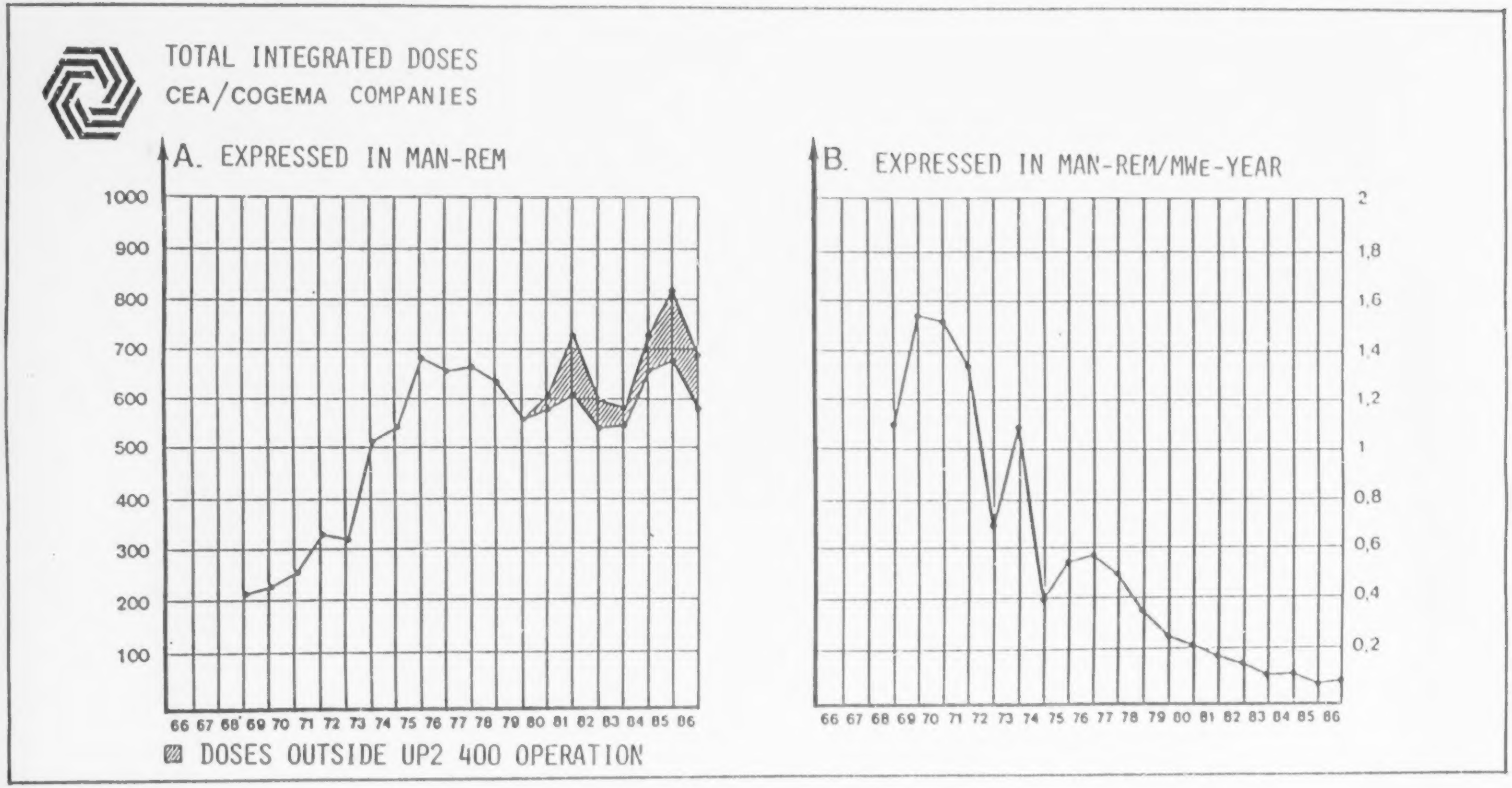

AVERAGE RADIATION DOSES
12 MONTHS/FULL BODY
— CEA/COGEMA
--- CONTRACTORS
MAXIMUM PERMISSIBLE DOSE
mRem
5000
4000
3000
2000
1000
500
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
— AVERAGE
mRem
5000
4000
3000
2000
1000
500
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85

FIGURE 3



TOTAL INTEGRATED DOSES
CEA/COGEMA COMPANIES

FIGURE 4

Comparison between the Marcoule and La Hague vitrification units

CHARACTERISTICS	AVM UNIT MARCOULE	R7 AND T7 UNIT LA HAGUE (AVM)
Number of vitrification lines	1 AVM line	3 AVM lines
Nominal capacity	36 l/hr HAW	2 x 60 l/h HAW
Max capacity	36 l/h	3 x 60 l/h
Glass capacity, nominal	15 kg/h glass	2 x 25 kg/h glass
Calciner diameter	25 cm	30 cm
Melting pot dimensions	= 170, O = 35 cm	Ovoid h = 95 cm L = 100, l = 35
Glass pouring	1 nozzle	2 nozzles
N° of process cells	One	Three
Other main hot cells	--	Five
Maintenance	Cranes plus MS	Cranes plus MS
Type of cranes	O/H crane	Modular crane
Canister size	H = 1000, O = 500	H = 1300, O = 430
Frequency to helter	10 khz	4 khz
Installed power induction	100 KW	200 KW

AMBASSADE DE FRANCE
AUX ETATS-UNIS

L'ATTACHÉ NUCLÉAIRE

SYMPOSIUM ON THE BACKEND OF THE FUEL CYCLE

Organized by the Bayerische Staadt Ministerium
Für Landesentwicklung und Umweltfragen

MUNICH, May 21, 1987

by Mr. Jean Lefèbvre
Director at the French Atomic Energy Commission
in charge of Nuclear Waste Policy

THE BACK END OF THE NUCLEAR FUEL CYCLE IN FRANCE

J.LEFEVRE

DRED - COMMISSARIAT A L'ENERGIE ATOMIQUE
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As everybody knows, France is committed to a major nuclear power program. To explain why, no one could possibly do better than quote the four reasons given by Lord Marshall last June, at the Geneva European Nuclear Conference :

One : France had no coal,

two : France had no oil,

three : France had no gas

four : France had no choice

These hard facts are certainly still with us; they have been behind our successive government's staunch support of nuclear power through the years. As a result , in 1986, practically 70% of the country's electricity was nuclear generated. This could not have been achieved, however, without the required research and development teams, technical know-how, industrial capabilities, and, last but not least, the very highest level of safety . Moreover, it does not necessarily explain why France has also opted for the reprocessing of spent fuel and the recycle of the recovered fissile and fertile material. I shall try and make clear both our strategy for the end of the nuclear fuel cycle and the reasons for our choice.

I. WHY DO WE REPROCESS SPENT FUEL ?

To start with the reasons for reprocessing - they were many and varied. Some are linked to the history of the development of nuclear power in France, others to economy , but the main one is that reprocessing is a logical follow-up of the nuclear power option : France is relatively lucky in having some domestic uranium resources. These, if duly husbanded, are sufficient to cushion any short term disruptions in world uranium supplies, whether they are due to political or economic upheavals or both, such as have been experienced in the oil market over the last ten to fifteen years. These domestic reserves cannot guarantee total long term deliveries to our power stations in all circumstances at a reasonable cost. Security of energy supply, vital to the economic and political survival of any nation, therefore makes reprocessing a must for France. It so happens that reprocessing was also a logical technical follow-up of our nuclear program effort. Originally developed for Defense objectives, successful reprocessing at Marcoule of the first natural uranium spent fuel elements, together with the somewhat premature hopes for the economic success of the fast breeder, opened great vistas . Building a new plant at La Hague, for the reprocessing of EDF and foreign civil power plant fuel, came as a matter of course, and , logically again, came the switch to light water fuel reprocessing. The world energy crisis and the ensuing committment to nuclear power, not only in France, but in many other countries, led to a surge in reprocessing orders and the decision, in 1977, to enlarge light water spent fuel reprocessing capacities at La Hague from 400 t/annum to 1600 t/ annum by the early nineties. Licence to build was given by one Government in early 1981 and confirmed by the next in 1982, following a major energy policy debate in Parliament, in october 1981, and the setting up of an ad hoc working group. Headed by an independant and universally respected scientist, Professor Castaing, this group was given the task of scrutinizing the La Hague plant and projects and report with recommendations to the government to go through with the building plans or not. Among the members were some of the most qualified and vocal opponents of reprocessing. It says much for their fairness, that the Group unanimously agreed that reprocessing technology both of natural and enriched spent fuel had been successfully mastered by the Commissariat à l'Energie Atomique "in availability and safety conditions ... which have not been questioned (by the Group)". Many detailed recommendations were made by the Group on this or that aspect of the project, and especially on some of the waste management options, but reprocessing per as passed the test and the project is nearing completion. Thanks to the recommendations, clear government instructions for long term waste management were given, and the necessary financial and structural impetus granted to the waste research and development program. But I will go back to that later. I should like first to add that the future of reprocessing is not necessarily linked to the technical and economic success of the fast breeder reactor. Recycling of plutonium in light water reactors has been carried out experimentally for years. EDF has openly announced their policy of proceeding to such recycling on an industrial basis. The first 8 tonnes of MOX will be loaded into the St Laurent power station in the autumn of this year. Refueling rate of the French power stations should increase to reach 90 to 100 metric tonnes in 1995, corresponding to ten 900 eMW reactors or so burning recycled plutonium. Low enriched uranium recovered by reprocessing can also be recycled in the enrichment plants. For the utilities, utilization of recycled uranium is a matter subject to optimization in terms of time schedule, stockpiling policy and reactor fuel management. The main consequence of course of the recycling of uranium and plutonium is the impact on uranium demand, as I stated before. It would amount, by 1995, to a maximum of 12 percent of uranium needs in the western world, which is not to be sneezed at. Incidentally, the EDF MOX decision confirms, if need be, the economic advantages of reprocessing.

A final major argument in favor of reprocessing is, of course, long term safety. With reprocessing and recycle, large quantities of plutonium are not left in the waste. The very small quantities of highly active and of long-lived radionuclides, including remaining traces, but traces only, of plutonium, are given the extremely elaborate and expensive treatment which must be accorded to the whole of the spent fuel element if it is not to be reprocessed. This brings me to the second and final part of my talk, which is a description of the long term waste management policy in France.

I will not limit my talk to reprocessing waste however, but cover the whole of the nuclear cycle including the power reactor itself, as is only logical.

II. NUCLEAR WASTE MANAGEMENT

As I explained before, despite inevitable adjustments to the general economic and energy picture, and whatever the political pressures, the French nuclear power program remains sizable : 44.9 eGW at the end of last year, 58 eGW by 1990 and a possible 70 eGW by the year 2000. Nuclear plants even now generate 70 % of our electricity, at a competitive cost.

The accompanying domestic fuel cycle industry covers all steps, from uranium mining and milling to the reprocessing of FBR fuel, and shortly to the fabrication of MOX fuel on an industrial scale.

Obviously, the problems posed by the ensuing radioactive waste have somewhat evelved since the early years of our Civil and Defense program, in the 40ies and 50ies. Manaagement had to adjust both to technological changes, and to the growing scale of the program, that of the industrial plants themselves and that of the overall volume of wastes. The organisation of waste management had to be reviewed, in order not only to meet these growing volumes with the corresponding industrial scale technology, but to take over the long term responsibility of nuclear wastes. Last but not least, the pressure of public opinion, in France as elsewhere, forced the parties concerned, who had tended to consider nuclear waste issues, like other nuclear safety issues, a matter for specialists to be settled between themselves and safety authorities, to come out into the open and publicise their policy - with the exercice in clarification that such publicising usually entails. Accordingly, waste management policy in France has been set out in the CEA "General Radioactive Waste Management Program", which followed the above quoted Parliamentary Debate on Energy of October 1981, was approved by Government and published on June 19, 1984.

Before briefly recalling the general lines of this policy, the structures and distribution of responsabilities should be described.

WHO DOES WHAT IN NUCLEAR WASTES ?

The broad outline of waste management policy, the national rules, regulations and control, as well as the authorization and licensing of nuclear installations, waste disposal site included, are the responsability of the government. The main ministry concerned is the Ministry responsable for Industry.

Short term management is carried out mainly by the waste producers themselves up to, and including, temporaty storage at the production site. Long term disposal is the responsibility of a specialized agency : ANDRA, set-up by the Government in 1979 within CEA.

ANDRA has a wide mission which covers :

. Selection, installation and management, of disposal sites,

. Setting specifications for the system of barriers set-up between the waste and the environment, namely, the waste packages themselves, and the site engineered barriers. The specifications ensure that the safety standards set by the ministry are correctly observed.

. Ensuring quality assurance and quality control both during treatment and conditioning of the waste, and at the disposal site. (Apart from the usual inspections and controls carried out by the specialised regulatory authorities).

. In order to carry out its mission, ANDRA must also make forecasts on the production of waste volumes, so as to program future disposal sites in time.

ANDRA is funded by the waste producers on a cost basis, according to the volume and nature of the wastes delivered. Prefunding of future disposal sites is also charged to the producers according to future delivery forecasts.

Waste producers include the national utility EDF, COGEMA, the fuel cycle CEA subsidiary, the CEA civil and military research centers, and the usual miscellaneous producers - universities, hospitals, industry etc.

R and D is mainly carried out and funded by CEA, with some contribution from the European Community, and, through ANDRA, from waste producers. These, mainly EDF, carry out some research in their own laboratories, as also do various Universities and Institutes, either under contract to CEA or through their own funds. The transfer of technology to industry is ensured through equipment and service suppliers, many of them subsidiaries of CEA or EDF. These also carry out some research themselves.

Needless to say, this presentation is a deceptive over-simplification. The licensing procedures for nuclear installations, including waste disposal sites, involves all major Departments concerned, especially the Health Department, who have a right of veto. It also involves the public through a public enquiry.Though the Authorities still have the last word, this entails supplying an independant enquiry commission with far more information than formerly and taking account of founded objections. Besides , the policy itself, the rules and specifications, and even the research program, are discussed in committees and commissions. These include, in some cases, trade-union and/or environmental group representatives, outside specialists etc.

WASTE MANAGEMENT POLICY

Nuclear wastes have been divided into three categories, according both to the technological problem posed by the level of their activity and to the health protection problem posed by their long term potential hazard.

Category A

Category A, to be disposed of in surface or near surface sites, includes low and medium level wastes containing mainly beta and gamma emitters whose half-life does not exceed 30 years, with an alpha emitter content no higher than 370 $Bq.g^{-1}$ (0.01 Ci/t) averaged over the site. Maximum individual package alpha emitter content must not normally exceed 3.7 $kBq.g^{-1}$ (0.1 Ci/t) ; this can be extended, on a case by case basis, to an individual maximum content of 18,5 $kBq.g^{-1}$ (0.5 Ci/t). These alpha emitter limits are computed for the end of the monitoring period, i.e. a maximum of 300 years after closure of the site.

Waste forms can be cement grouts, bitumen or polymer resins, mixed forms or any approved solid form. The engineered site barriers developed by ANDRA are the now well known "tumulus" or mound, and monolith concept.

The one available disposal site of the sort has been running for 16 years in the north west of France, close to the La Hague reprocessing plant. It will be filled to its 400000 cubic meter capacity in a few years time. Total Category A waste volume is expected to reach about 800 000 cubic meters by the year 2000.

Category B

Category B wastes are any low and medium level wastes with a higher alpha content than admitted on surface sites. (TRU wastes). They stem mainly from reprocessing activities, with some military and research wastes. A great effort has been made and is still in progress in order to reduce their quantity, through sorting, separation and recycle, combined or added to volume reduction by incineration, crushing, leaching, etc. Embedded in cement grouts, polymer resins, bitumen, or mixed matrices, all TRU wastes are put into temporary storage, awaiting the availability of a deep geological disposal site, which will not be for some years. The volume is expected to reach between 60000 and 80000 cubic meters by the year 2000.

Category C

Category C is made up of high level wastes. The policy is to vitrify them, as is being done since 1978 in the industrial AVM plant at Marcoule, where over 1400 steel containers have been produced, containing about 560 tons of glass, representing over 1000 m^3 of liquid high level wastes.

Two larger size plants are being built for the vitrification of the high level liquid wastes from the reprocessing of enriched fuel at La Hague. The first, R7, will be available for active tests in 1987. The glass containers will be stored for cooling for a probable minimum period of 30 years, which leaves some time for preparing a final disposal site, but not much, since real disposal conditions must be known beforehand to optimize the overall barrier system.

THE DISPOSAL SITE PROGRAM

As the existing low level waste disposal site will be filled to capacity within a few years' time, the Government has given ANDRA the go ahead for submitting two further sites for approval, so that one or both could be commissioned in 1990. The preliminary work carried out by the bureau of mines (BRGM) for ANDRA made it possible to narrow down the search to three counties. Finally one site has been identified as suitable and the licensing procedure is now in progress. This entailed an intensive information campaign by ANDRA among all sectors of the population, starting with local authorities and the press.

As far as deep geological disposal is concerned, the Government has requested CEA to submit a proposal for a site for an underground laboratory. Four sites, one for each of four geological formations, salt, granite, clay and shale, have been selected early this year for further exploration, before chosing one of them for installing the laboratory. It is hoped that the site will be good enough to be qualified as a repository ; should the site prove not to be suitable, another laboratory would be built in one of the other three sites. In the other event, the laboratory would be developed into a final repository.

Although some options may still be open, the general lines of waste management policy have been laid and the major part of the techniques are available here and now.

CONCLUSIONS

To summarize, reprocessing has proven to be technically succesful, with a level of safety which is entirely satisfying not only for the public, but also for the workers; with the acquired experience, confidence in reliability and performance make the economics ever more attractive; finally, backed with a major research and development effort, the long term waste management program is well under way : there seem no reasons to doubt our confirming our achievements and realising our hopes for cheap power with safety for the future as well as for the present.

FUEL REPROCESSING INSTALLATIONS

GRAPHITE GAS NAT. U.	LWR	FBR
UP_1 MARCOULE FROM 1958 UP_2 LA HAGUE 1966 - 1986	UP_2 LA HAGUE FROM 1976 UP2 800 FROM 1992 UP_3 LA HAGUE FROM 1989	AT_1 LA HAGUE 1969-1979 UP_2 LA HAGUE (IN DILUTION) SAP MARCOULE 1979 - 1982 TOR (5t/y) 1987 MAR 600 DECISION PENDING

A V M

OPERATION RESULTS BY MARCH 1 ST 1987

VOLUME OF TREATED LIQUID HL WASTE_1074M^3

NUMBER OF CASKS ______________ 1432

WEIGHT OF GLASS ______________ 490 T

VOLUME REDUCTION FACTOR __________ 5 – 6

HOURS WORKED ______________ > 37200

LIGHT WATER FUEL REPROCESSING AT LA HAGUE BY JAN. 1 ST 1987

> 5000 T SHIPPED FROM 60 EUROPEAN AND JAPANESE REACTORS

> 1600 T REPROCESSED

> 1200 TU RECYCLED IN ENRICHMENT PLANTS

> 7 T P_U RECYCLED IN FUEL FABRICATION PLANTS